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SST Technology
Follow-On Program—Phase II
NOISE SUPPRESSOR/NOZZLE DEVELOPMENT
VOLUME III

NOISE TECHNOLOGY—BACKUP DATA REPORT

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D6-42444

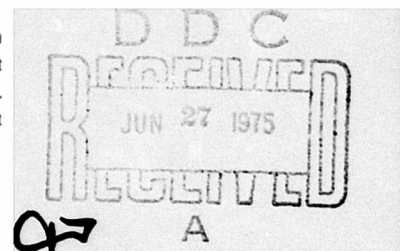
March 1975

FINAL REPORT

Task III

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Prepared for
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TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract Jet noise suppression technology was studied in this program and reported in Volume II of this document. The data base for the technology studies consisted of static far field noise signatures and jet noise source location measurements for a systematic set of multitube nozzles, with and without ejectors. Acoustic results were complemented by flow profile data to better understand the noise generation and suppression mechanisms. A representative set of test configurations were chosen for which the basic data has been compiled in this report in a standardized format to be readily available to those researchers who may desire to study the data behind the discussions in Volume II. Because of limitations of space not all of the available data could be included. The data presented in this report consists of sound power spectra, sound pressure spectra, directivity patterns, extrapolated perceived noise level characteristics, jet noise source location data and jet flow profiles.		
17. Key Words JET NOISE MULTITUBE JETS EJECTORS EJECTOR/SUPPRESSORS FLOW PROFILES		18. Distribution Statement Approved for U.S. Government only. This document is exempted from public availability because of restrictions imposed by the Export Control Act. Transmittal of this document outside the U.S. Government must have prior approval of the Supersonic Transport Office.
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PREFACE

This is one of a series of final reports on noise and propulsion technology submitted by the Boeing Commercial Airplane Company, Seattle, Washington, 98124, in fulfillment of Task III of Department of Transportation Contract DOT-FA-72WA-2893, dated 1 February 1972.

To benefit utilization of technical data developed by the noise suppressor and nozzle development program, the final report is divided into 10 volumes covering key technology areas and a summary of total program results. The 10 volumes are issued under the master title, "Noise Suppressor/Nozzle Development." Detailed volume breakdown is as follows:

		Report No.
Volume I	— Program Summary	FAA-SS-73-11-1
Volume II	— Noise Technology	FAA-SS-73-11-2
Volume III	— Noise Technology—Backup Data Report	FAA-SS-73-11-3
Volume IV	— Performance Technology Summary	FAA-SS-73-11-4
Volume V	— Performance Technology—The Effect of Initial Jet Conditions on a 2-D Constant Area Ejector	FAA-SS-73-11-5
Volume VI	— Performance Technology—Thrust and Flow Characteristics of a Reference Multitube Nozzle With Ejector	FAA-SS-73-11-6
Volume VII	— Performance Technology—A Guide to Multitube Suppressor Nozzle Static Performance: Trends and Trades	FAA-SS-73-11-7
Volume VIII	— Performance Technology—Multitube Suppressor/Ejector Interaction Effects on Static Performance (Ambient and 1150° F Jet Temperature)	FAA-SS-73-11-8
Volume IX	— Performance Technology—Analysis of the Low-Speed Performance of Multitube Suppressor/Ejector Nozzles (0-167 kn)	FAA-SS-73-11-9
Volume X	— Advanced Suppressor Concepts and Full-Scale Tests	FAA-SS-73-11-10

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1.0 INTRODUCTION	1
2.0 TEST DATA	2

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SYMBOLS AND ABBREVIATIONS

A_g	Nozzle exit area
D_E	Equivalent flow area conical nozzle diameter
Hz	Hertz (frequency)
HNTF	Hot Nozzle Test Facility
NPR	Nozzle pressure ratio
OASPL	Overall sound pressure level
P_{amb}	Ambient pressure
PNL	Perceived noise level
PNdB	Perceived noise in units of decibels
PWL	Sound power level
R.H.	Relative humidity
SPL	Sound pressure level
T_{amb}	Ambient temperature
T_T	Total temperature
V_J	Jet velocity
μ Bar	micro-Bar (pressure)
x	distance

1.0 INTRODUCTION

The model scale jet noise technology results were analyzed and discussed in Volume II of this report. The large quantity of test data that was acquired for the purpose of the technology studies could not be documented adequately together with the final analysis in one book. Therefore, a separate test data report has been prepared to preserve a representative cross-section of test data for those investigators that require to examine in more detail the information that formed the foundation for Volume II. Even with this approach 100% documentation of test data is beyond the scope of this report.

It was decided to arrange the test data in order of nozzle configurations. For each nozzle configuration a hardware and test parameter description is given, followed by key examples of PWL, SPL and PNL spectra, beam patterns, "normalized" noise levels, and noise suppression values. SPL and PNL spectra are presented for only two angles, 110° and 130° , which are representative of peak premerged and postmerged noise respectively. This data is then followed by noise source location results and flow profile curves for those configurations where such data was acquired.

2.0 TEST DATA

Test data for the following model scale nozzle configurations appears in this data report.

Nozzle	Description	Page
4.16" RC	4.16 Inch Diameter, Round Convergent Nozzle	6
6" RC	6 Inch Diameter, Round Convergent Nozzle	27
37T-3.3AR-CPA-RT/RC	37 Tubes, 3.3 Area Ratio, Close-Packed Array, Round Tubes with Round Convergent Ends	34
7T-3.3AR-CPA-ET/RC	7 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	58
19T-3.3AR-CPA-ET/RC	19 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	83
37T-3.3AR-CPA-ET/RC	37 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	108
37T-3.3AR-CPA-ET/RC w/3.1AR EJECTOR	37 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends with 3.1 Area Ratio Ejector, $L/D_E = 2$ Long	121
61T-3.3AR-CPA-ET/RC	61 Tubes, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	143
37T-2.75AR-CPA-ET/RC	37 Tubes, 2.75 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	168
37T-4.5AR-CPA-ET/RC	37 Tubes, 4.5 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	194
37T-6.0AR-CPA-ET/RC	37 Tubes, 6.0 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends	218
37T-3.3AR-RA-RT/NC	37 Tubes, 3.3 Area Ratio, Radial Arrangement, Round Tubes with Non-Convergent Ends	243

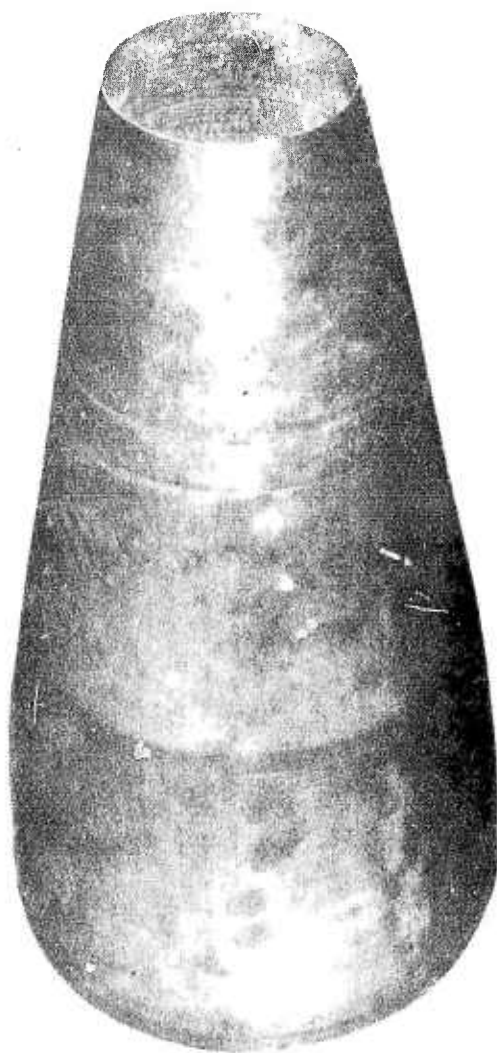
Nozzle	Description	Page
37T-4.5AR-RA-ET/RC	37 Tubes, 4.5 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends	268
31T-2.75AR-RA-ET/RC	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends	287
31T-2.75AR-RA-ET/RC w/2.6AR-EJECTOR	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends with 2.6 Area Ratio Ejector, $L/D_E = 2$ Long	299
31T-2.75AR-RA-ET/RC w/3.1AR-EJECTOR	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends with 3.1 Area Ratio Ejector, $L/D_E = 2$ Long	309
31T-2.75AR-RA-ET/RC w/3.7AR-EJECTOR	31 Tubes, 2.75 Area Ratio, Radial Arrangement, Elliptical Tubes with Round Convergent Ends with 3.7 Area Ratio Ejector, $L/D_E = 2$ Long	319
42T/Annulus-3.3AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 3.3 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 0.383" Wide Annulus	329
42T/Annulus-3.0AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 3.0 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 0.533" Wide Annulus	352
42T/Annulus-2.6AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 2.6 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 0.8" Wide Annulus	362
42T/Annulus-2.4AR-CPA-ET/RC	42 Tubes with Annulus and Plug, 2.4 Area Ratio, Close-Packed Array, Elliptical Tubes with Round Convergent Ends, 1.067" Wide Annulus	372

Nozzle	Description	Page
61T-3.1AR-CPA-RT/NC	61 Tubes, 3.1 Area Ratio, Close-Packed Array, Round Tubes with Non-Convergent Ends	392
61T(Canted)-3.1AR-CPA-RT/NC	61 Tubes with the Outer Row of 24 Tubes Canted Outwards, 3.1 Area Ratio, Close-Packed Array, Round Tubes with Non-Convergent Ends	401
85T-3.1AR-CPA-RT/NC	85 Tubes, 3.1 Area Ratio, Close-Packed Array, Round Tubes with Non-Convergent Ends	410

Typically the noise data for each test configuration is arranged in the following order. For some test configurations, however, not all of these pages or data formats were available and hence do not appear in this report.

Page Order	Description
1	Test Hardware Photograph
2	Test Hardware Schematic
3	Table of Test Conditions
4	1/3 Octave Band PWL Spectrum
5	1/3 Octave Band SPL Spectrum at 110° from Nozzle Inlet Axis
6	1/3 Octave Band SPL Spectrum at 130° from Nozzle Inlet Axis
7	Overall SPL Beam Patterns
8	2128 Ft. Sideline PNL versus Ideal Jet Velocity
9	2128 Ft. Sideline PNL Suppression versus Ideal Jet velocity
10	2128 Ft. Sideline PNL Beam Patterns
11	2128 Ft. Sideline, 1/3 Octave Band SPL Spectrum at 110° from Nozzle Inlet Axis
	2128 Ft. Sideline, 1/3 Octave Band SPL Spectrum at 130° from Nozzle Inlet Axis
	Table of Jet Noise Source Location Test Conditions
15	1/3 Octave Band "Space Averaged" SPL Spectra versus Jet Length

Page Order	Description
16	Jet Noise Source Intensity Distributions
17	Peak Jet Noise Source Locations
18	Total Pressure Profile @ $x/D_E = 1$
19	Total Pressure Profile @ $x/D_E = 5$
20	Total Temperature Profile @ $x/D_E = 1$
21	Total Temperature Profile @ $x/D_E = 5$
22	Static Pressure Profile @ $x/D_E = 1$
23	Static Pressure Profile @ $x/D_E = 5$



4.16 IN. DIA. REFERENCE NOZZLE

TEST CONDITIONS

NOZZLE: 4.16 IN. DIA., ROUND CONVERGENT

FACILITY: HNTF

DATE: 6-11-73

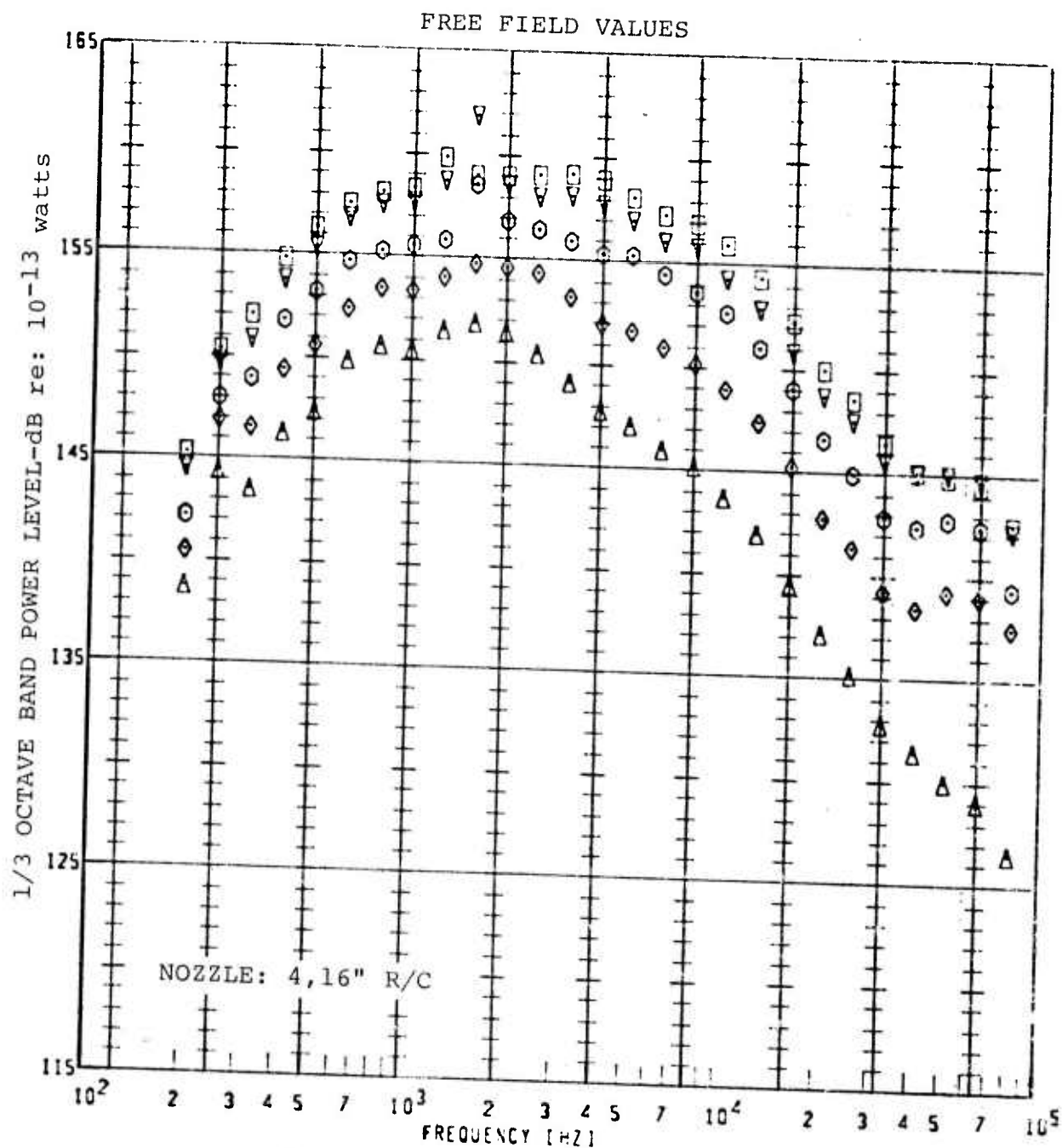
T_{AMB} = 65°F

R.H. = 55.5%

SCALE MODEL A₈ = 13.6 in.²

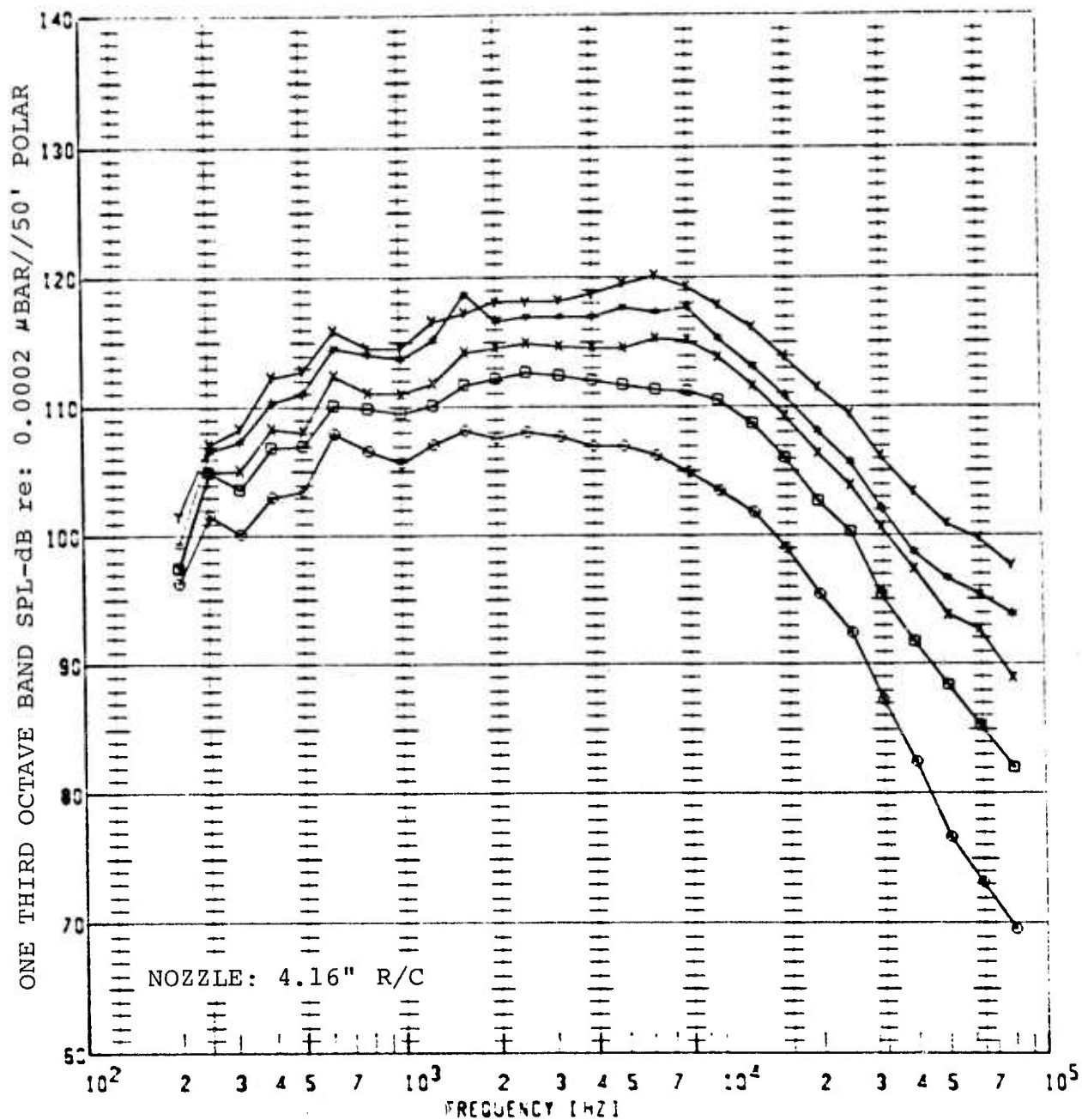
<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
007	2.0	1150°F	1875 fps		
"	2.5		2126		
"	3.0		2303		
"	3.5		2437		
"	4.0		2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



JET NOISE POWER SPECTRA

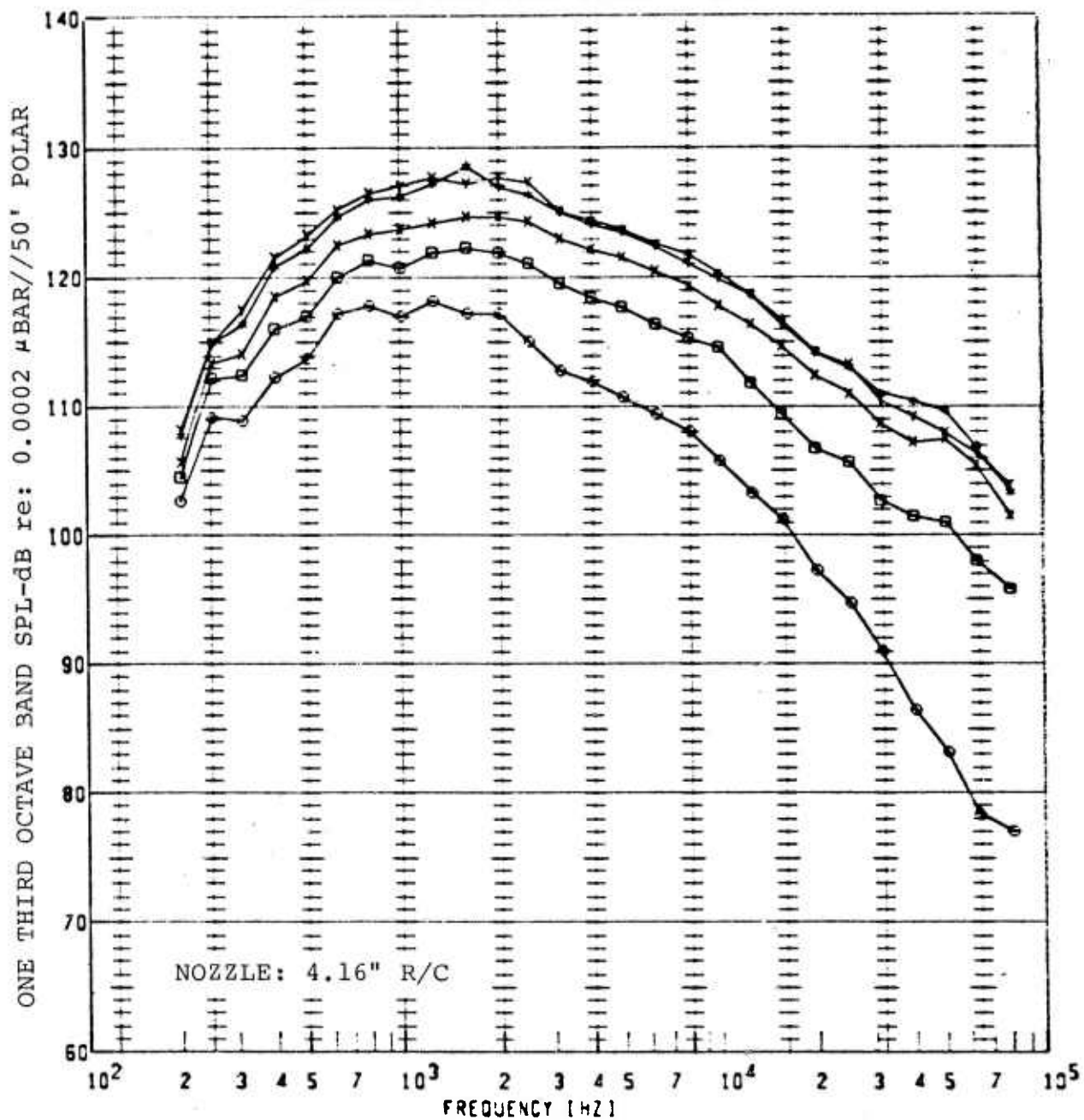
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	DASPL (C9)
o	0076	1150°F	2.000	110°	53FP	118.7
o	0076	1150	2.500		53FP	123.1
x	0076	1150	3.000		53FP	125.7
+	0076	1150	3.500		53FP	128.2
y	0076	1150	4.000		53FP	129.7

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

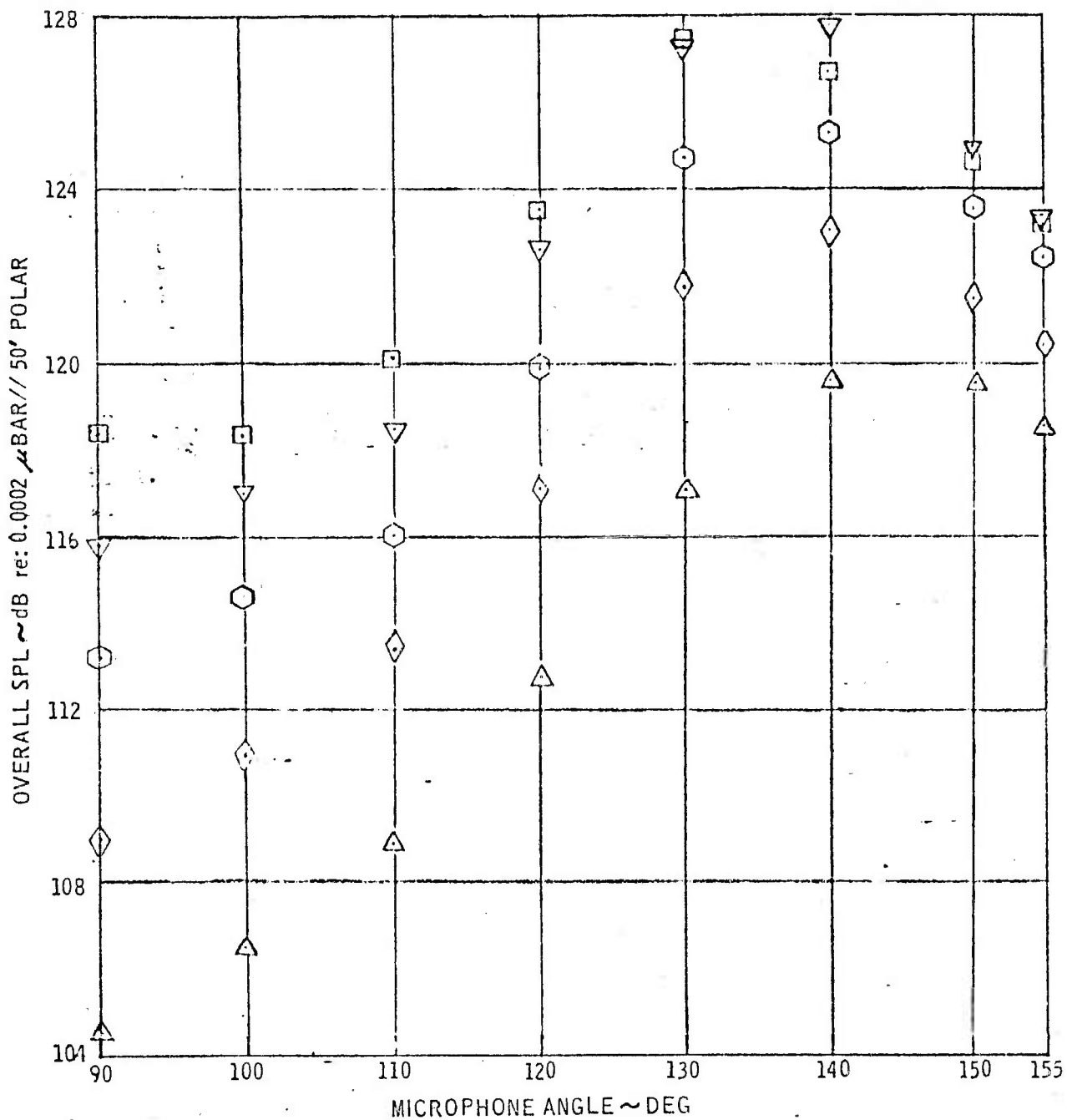
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	DASPL (dB)
○	0076	1150°F	2.000	130°	SCFP	126.9
□	0076	1150	2.500	↓	SCFP	131.5
x	0076	1150	3.000	↓	SCFP	134.5
*	0076	1150	3.500	↓	SCFP	137.1
Δ	0076	1150	4.000	↓	SCFP	137.3

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

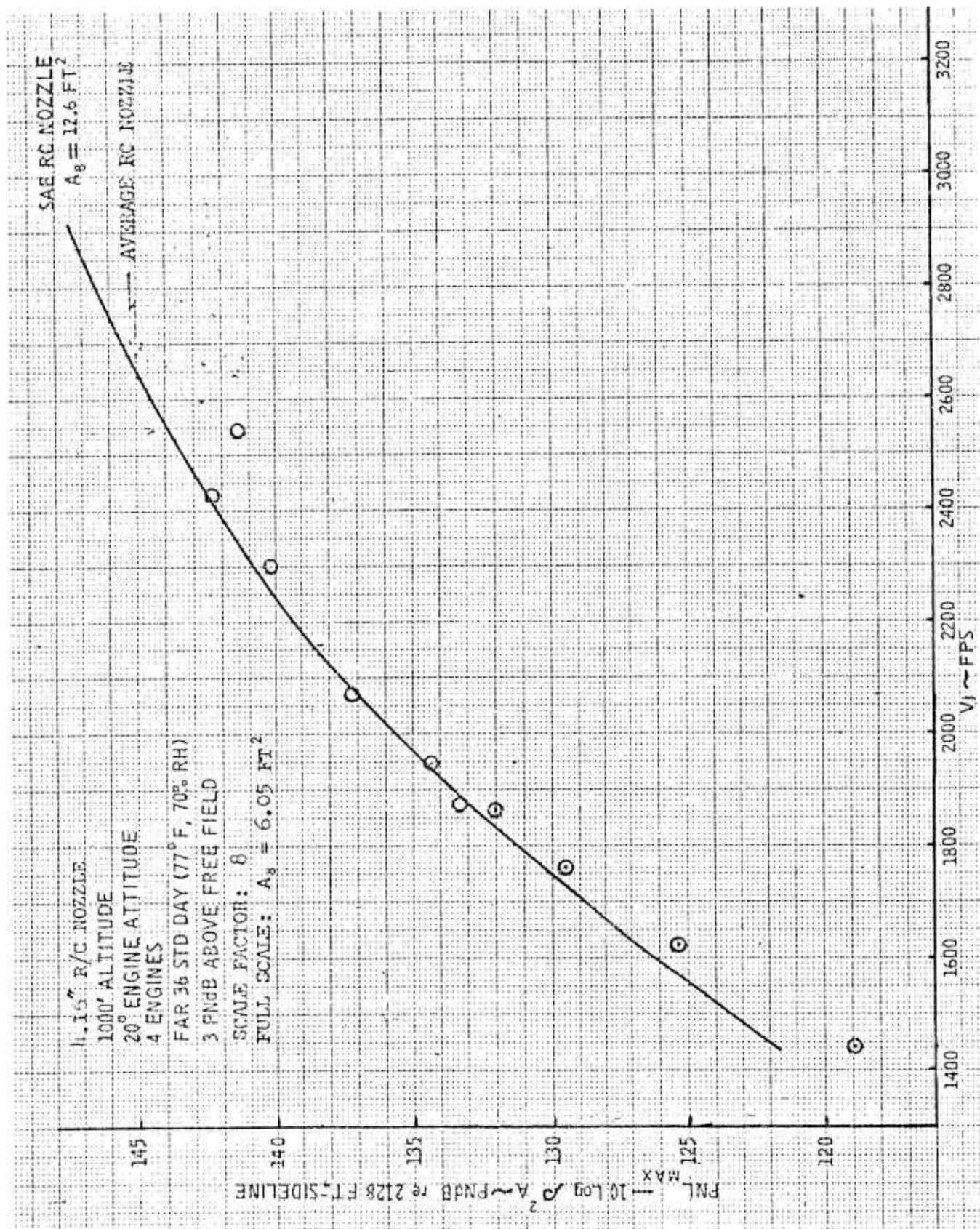
FREE FIELD VALUES



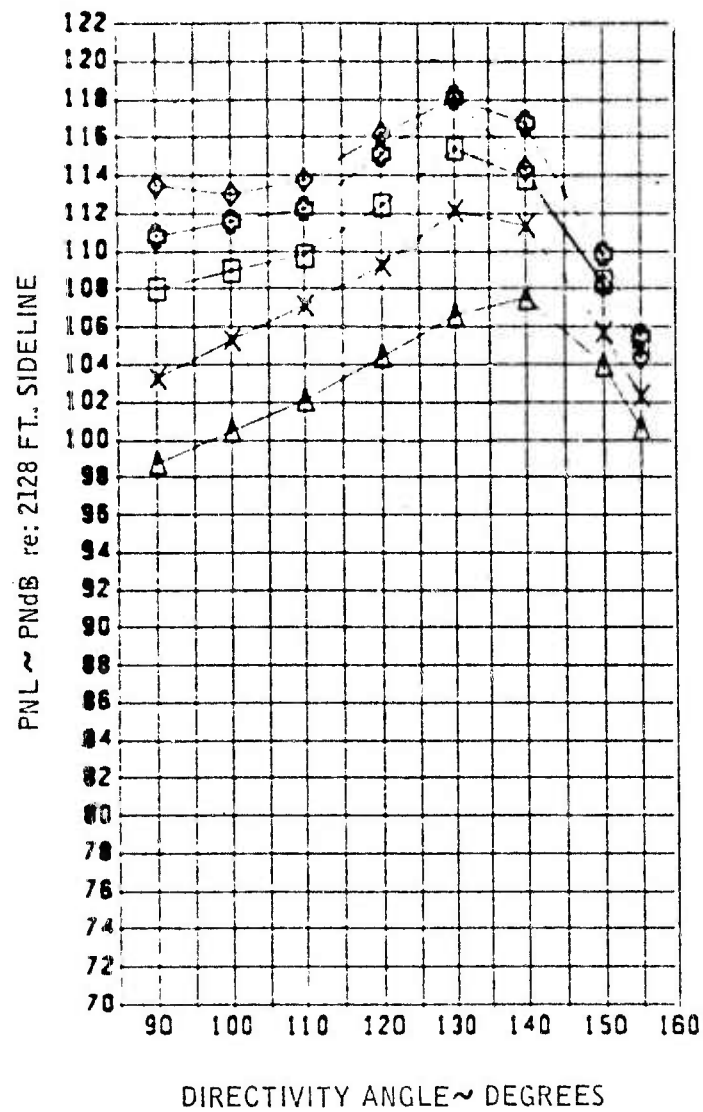
NOZZLE: 4.16" R/C

PLOT SYMBOL	RUA NUMBER	PRESSURE RATIO	SET TEMP
△	007	2.00	1150°F
◇	007	2.50	1150
○	007	3.00	1150
▽	007	3.50	1150
□	007	4.00	1150

OASPL BEAM PATTERNS



NOZZLE: 4.1" R/C

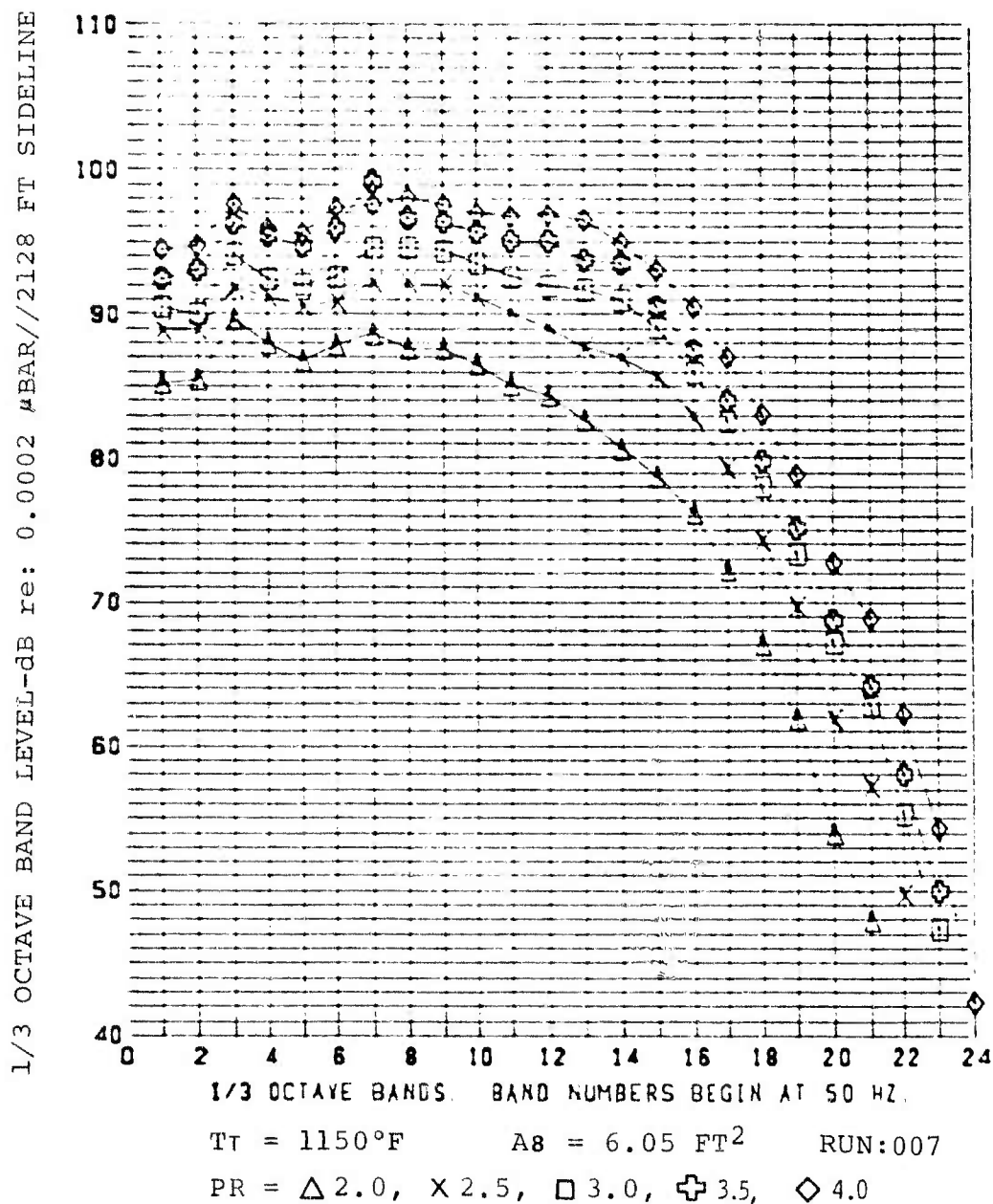


TT = 1150°F A8 = 6.05 FT² RUN:007
 PR = Δ 2.0, X 2.5, □ 3.0, + 3.5, ◇ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

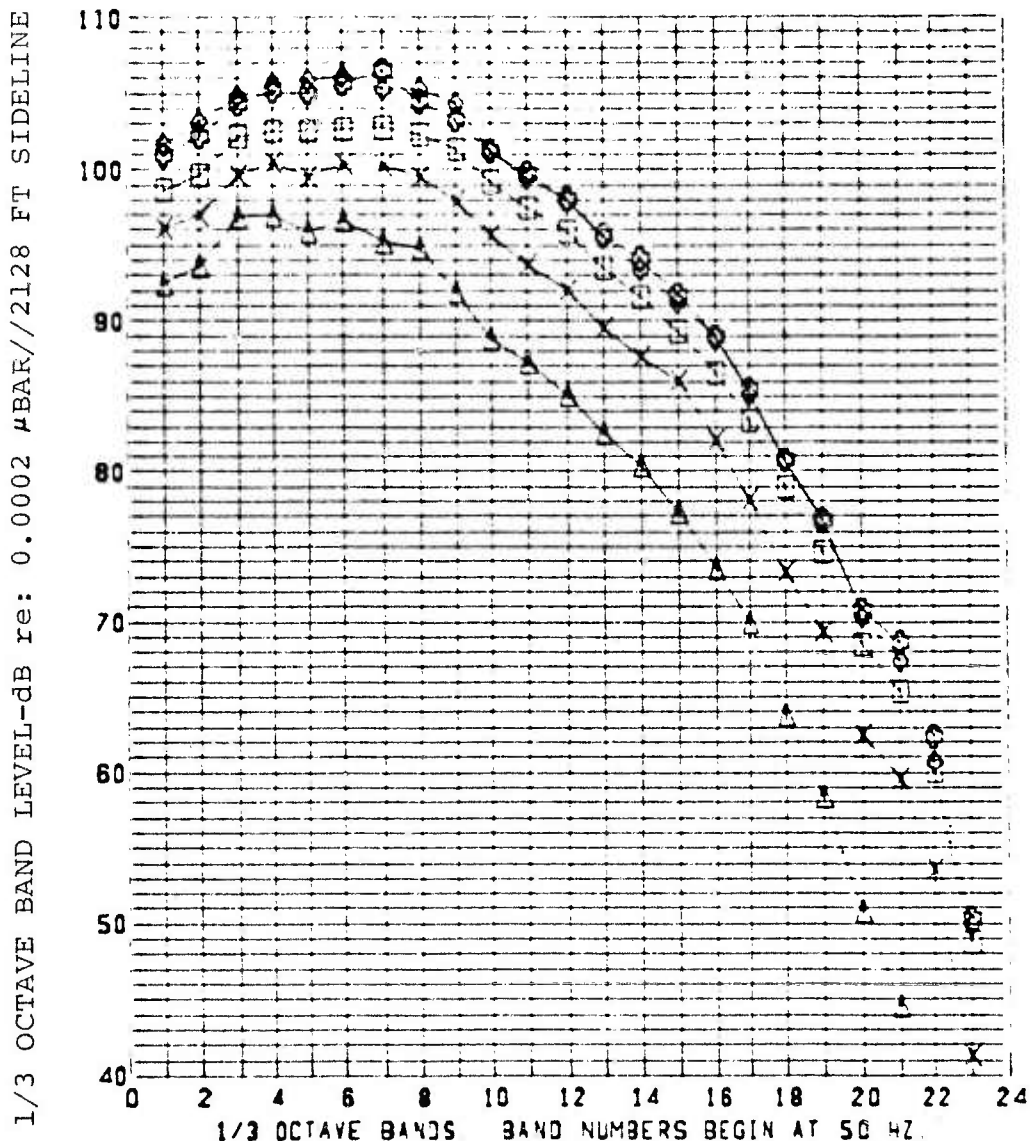


NOZZLE: 4.16 " R/C

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



TT = 1150°F A8 = 6.05 FT² RUN: 007

PR = Δ 2.0, X 2.5, \square 3.0, \oplus 3.5, \diamond 4.0

NOZZLE: 4.16 R/C

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 4.16" R/C

FACILITY: WALL ISOLATION FACILITY

DATE: August 11, 1972

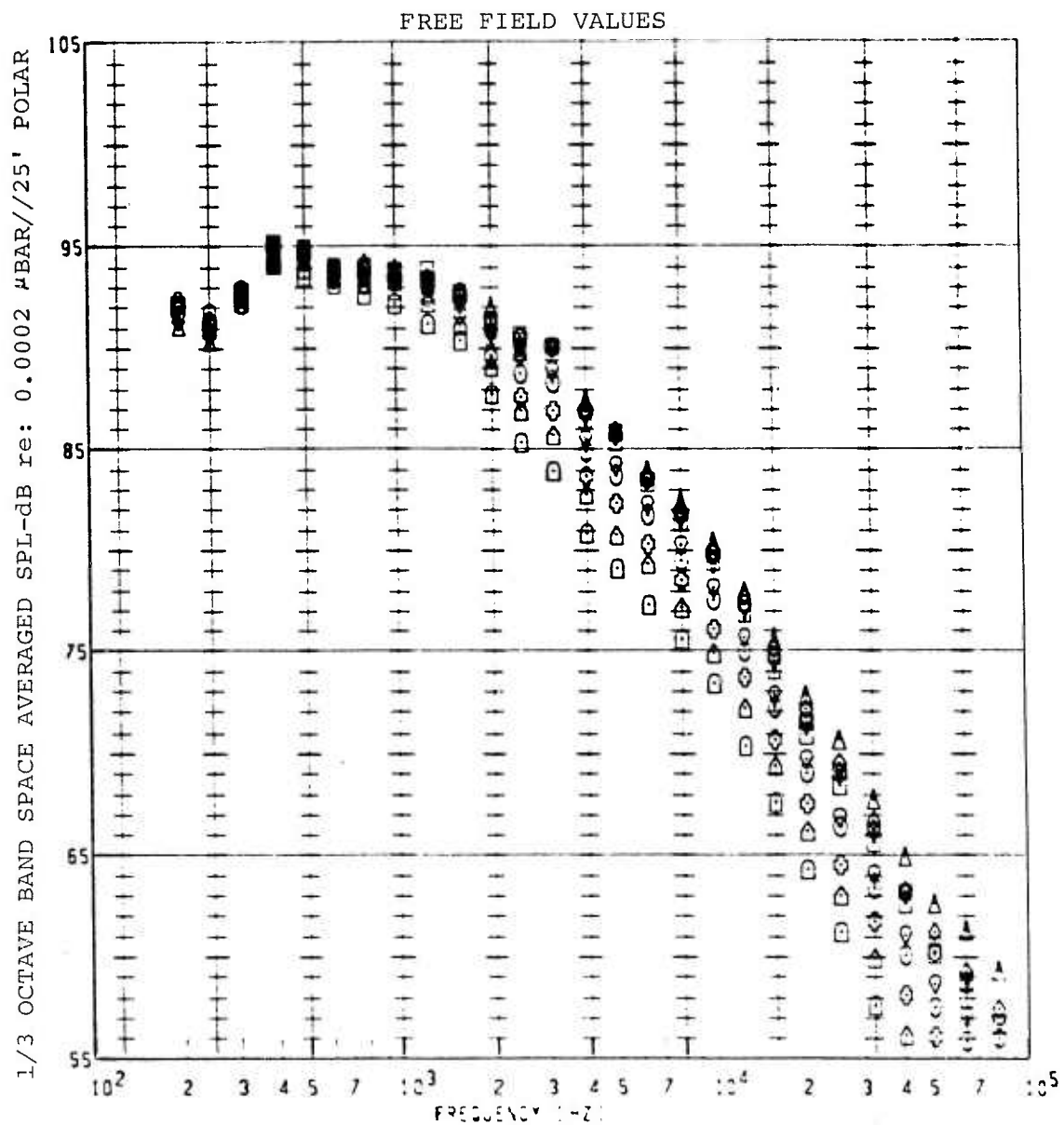
P_{AMB} = 30.3 in Hg **T_{AMB}** = 71°F **R.H.** = 49%

NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

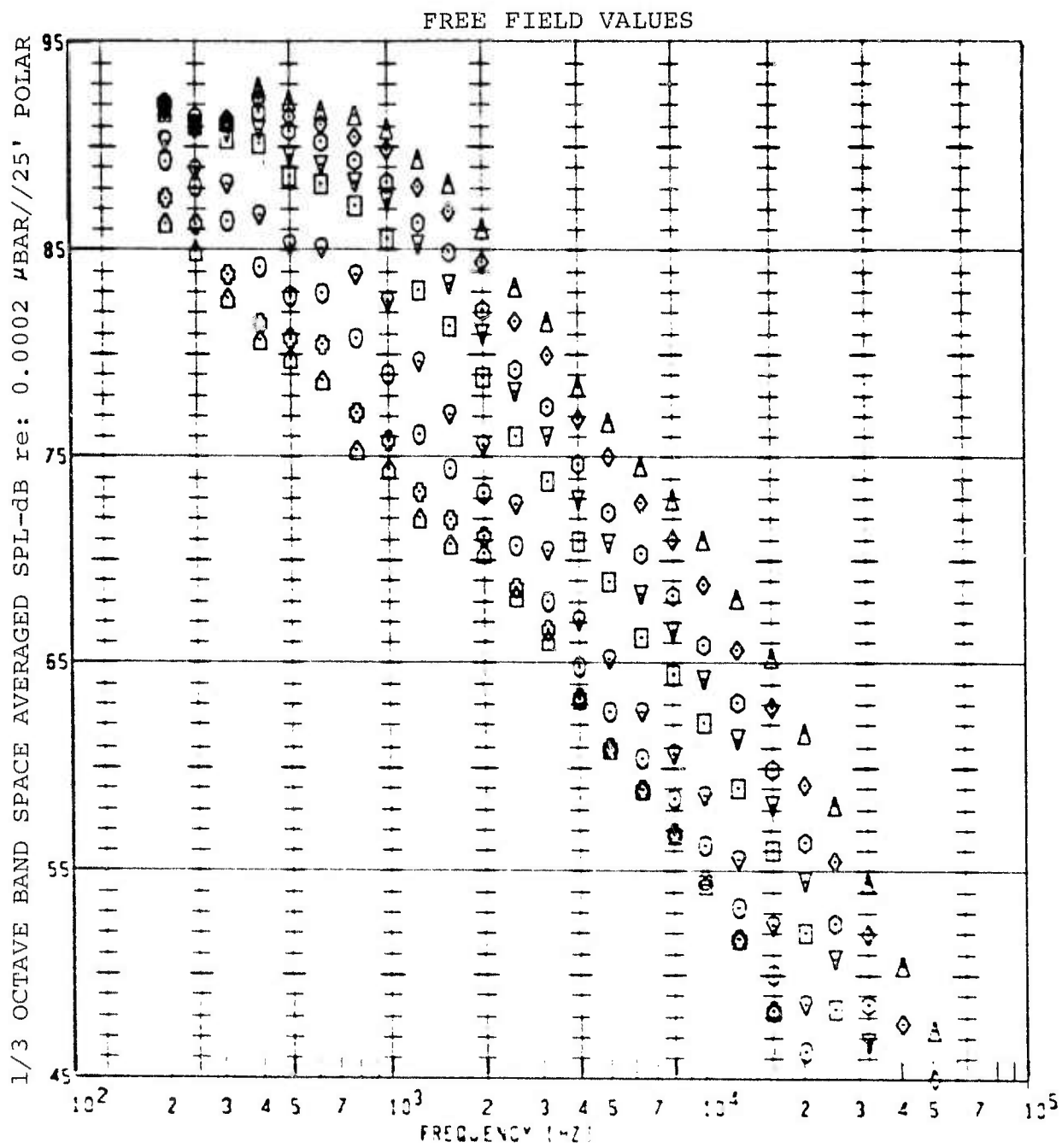
SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
1	0.0 x/D	6.0 in.		
2	1.0	6.0		
3	2.0	7.4		
4	3.0	8.4		
5	4.0	9.4		
6	5.0	10.4		
7	6.0	11.4		
8	7.0	12.4		
9	8.0	13.6		
10	9.0	14.4		
11	10.0	15.6		
12	11.0	16.0		
13	12.0	16.4		
14	13.0	17.0		
15	14.0	17.4		
16	16.0	22.4		
17	18.0	24.4		
18	20.0	26.4		
19	21.0	28.4		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC



PLOT SYMBOL	RUN NUMBER	TEMP °F	P.R.	AXIAL LOCATION, X/D
△	1	1150 °F	3.0	0.0
◇	2			1.0
○	3			2.0
▽	4			3.0
□	5			4.0
◊	6			5.0
⊙	7			6.0
⊗	8			7.0
⊠	9			8.0
⊡	10			9.0



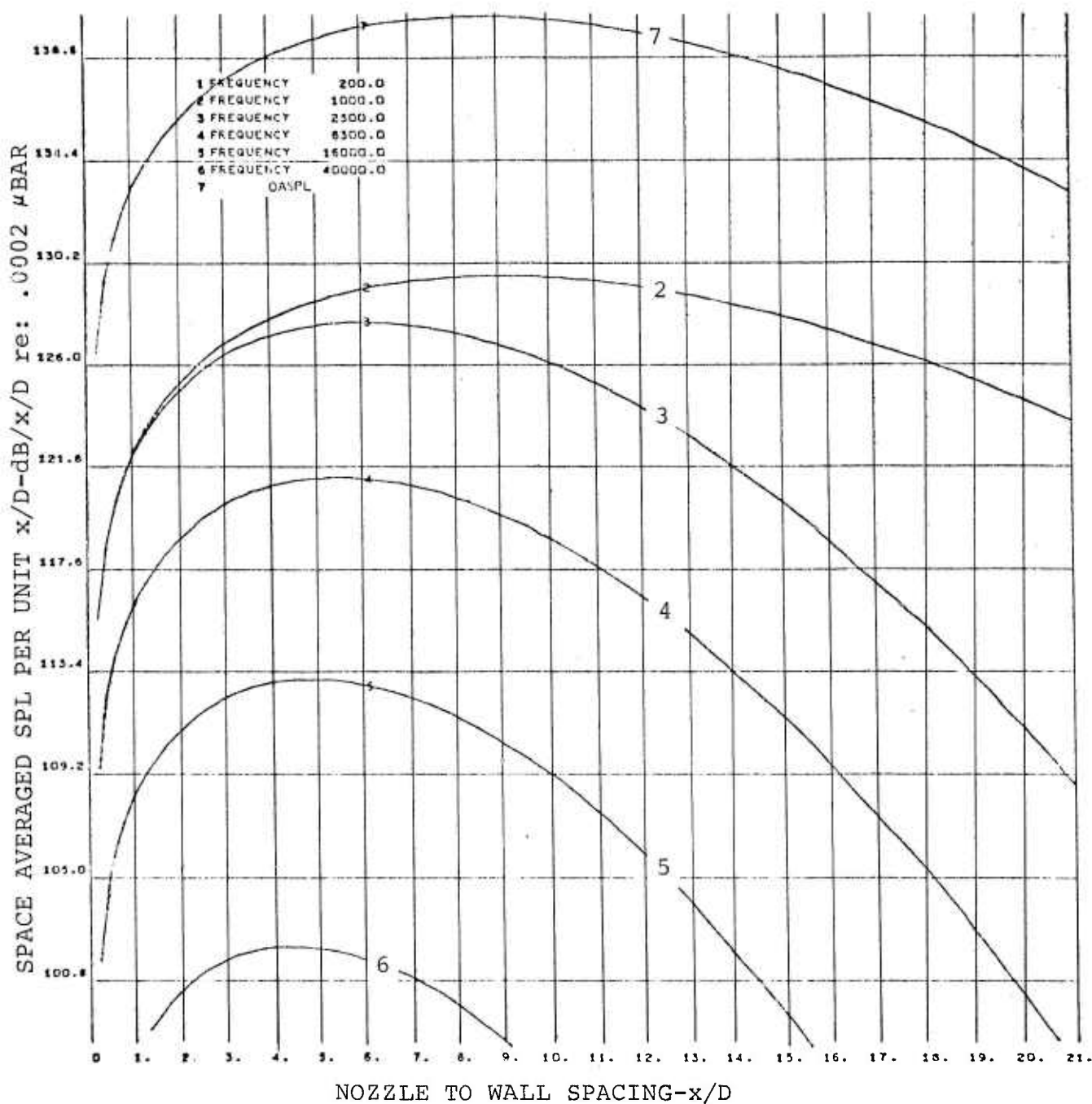
POINT SYMBOL	RUN NUMBER
△	11
◇	12
○	13
▽	14
□	15
◇	16
○	17
◇	18
△	19

TEST TEMPERATURE
1150 °F

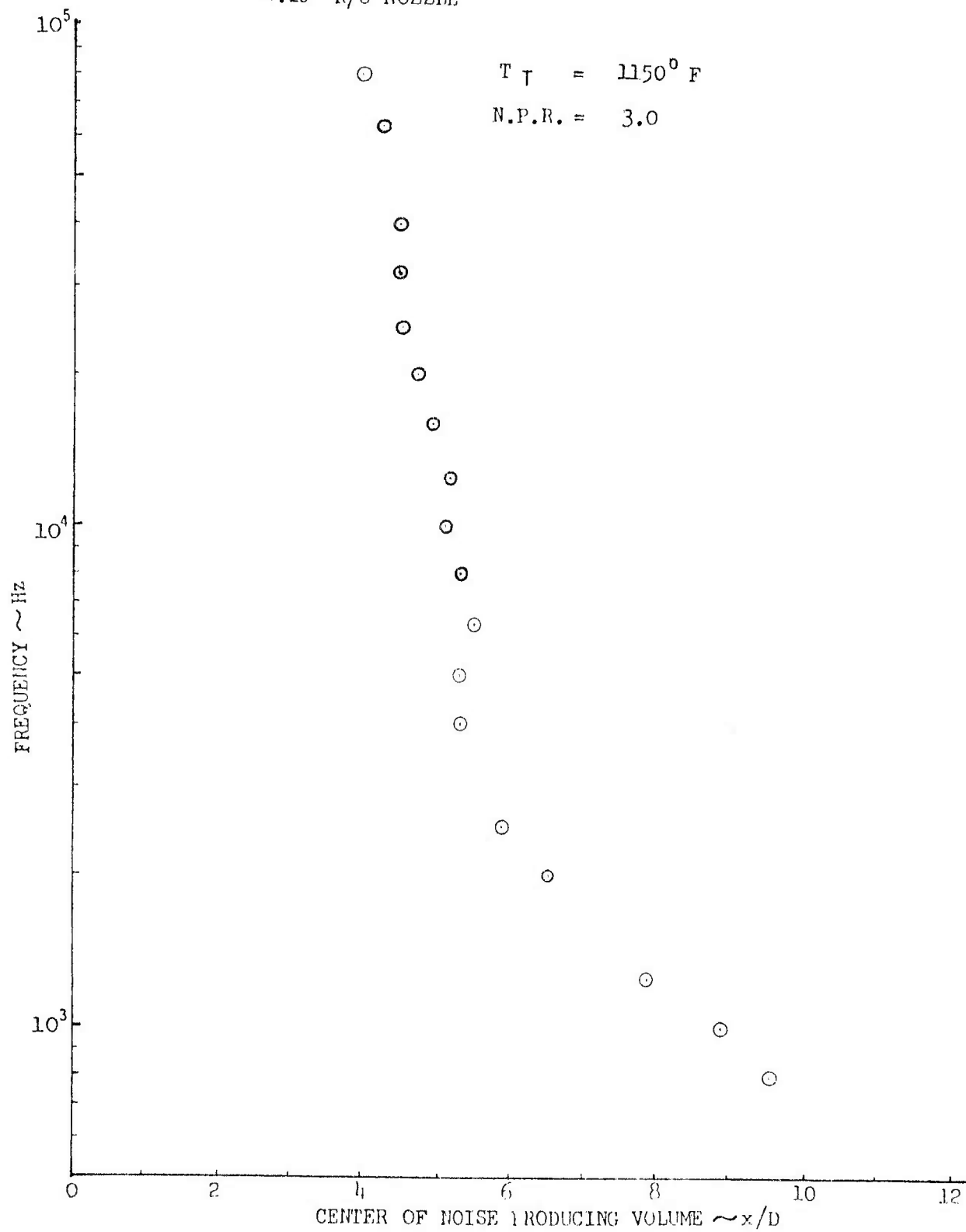
↓

PRESSURE RATIO	AXIAL LOCATION, x/D
3.0	10.0
	11.0
	12.0
	13.0
	14.0
	15.0
	16.0
	18.0
	20.0
	21.0

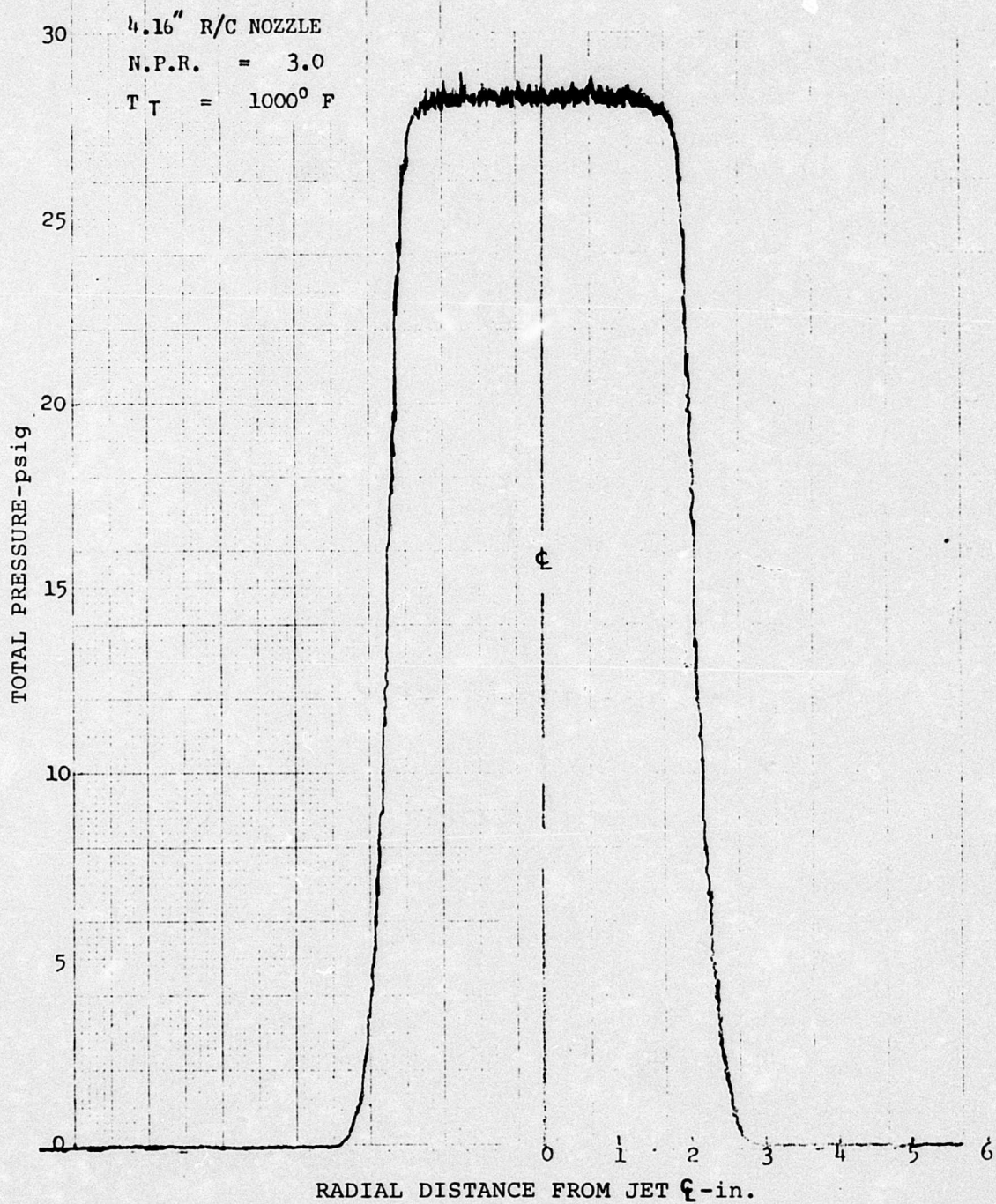
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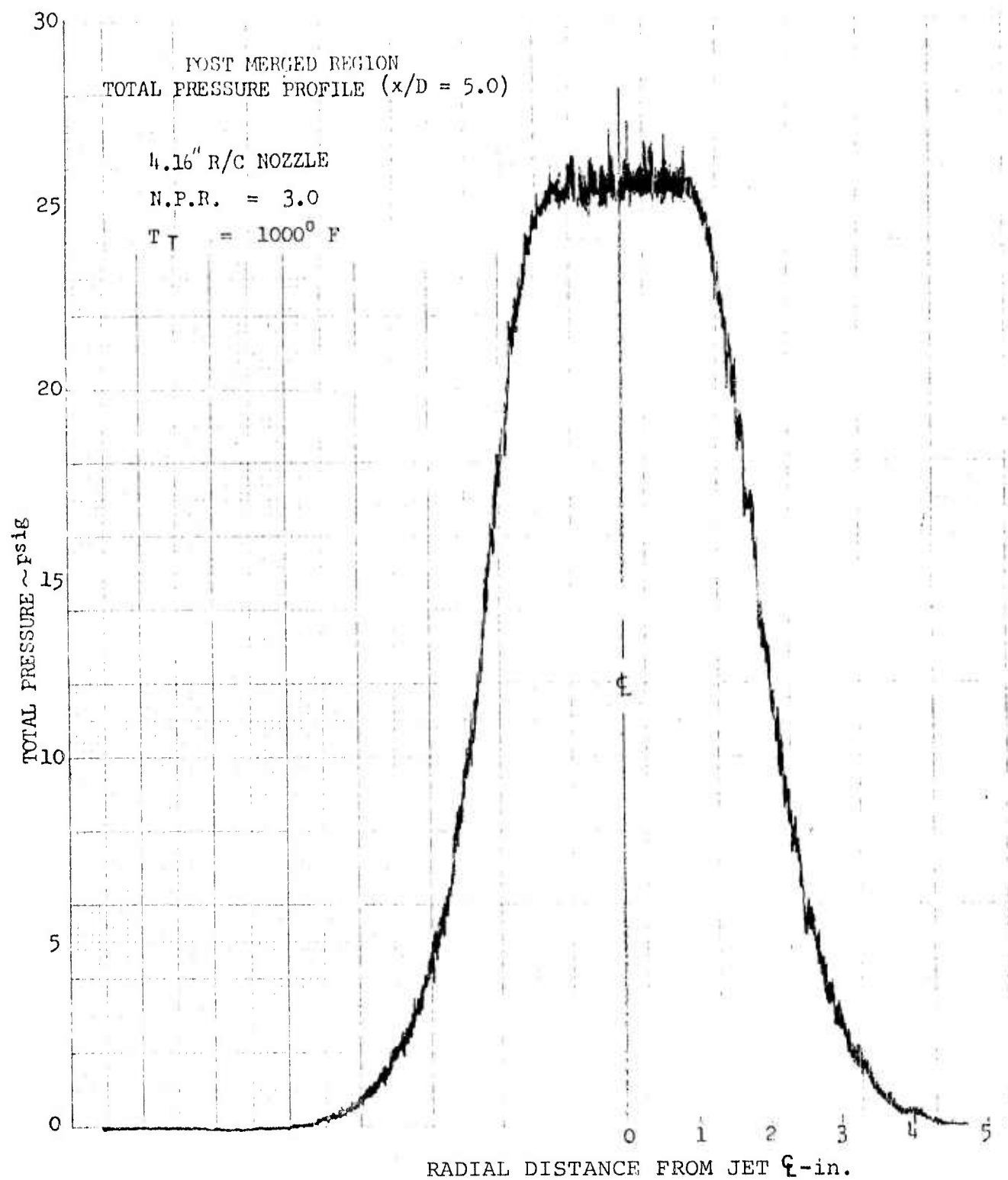


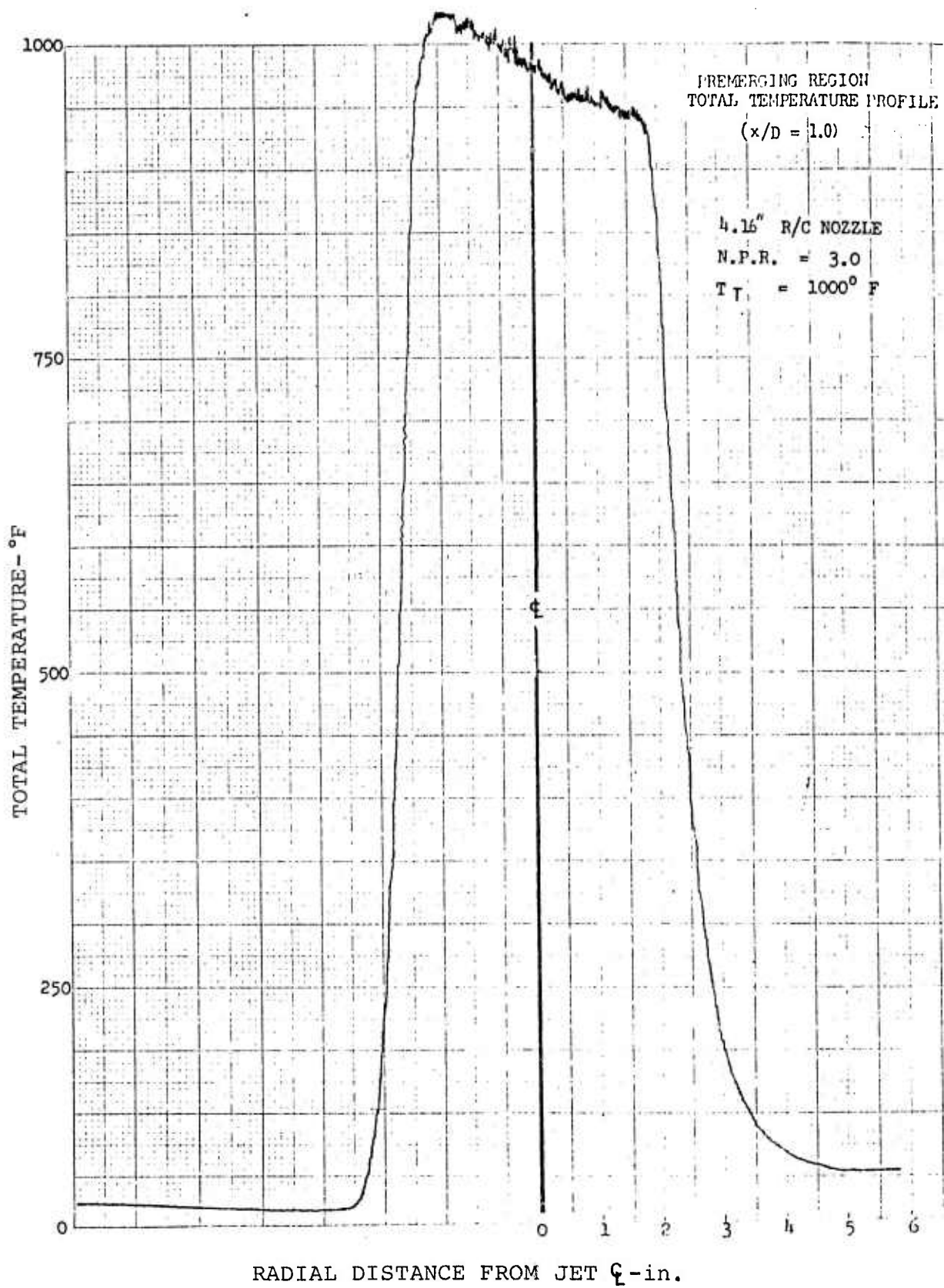
4.16" R/C NOZZLE

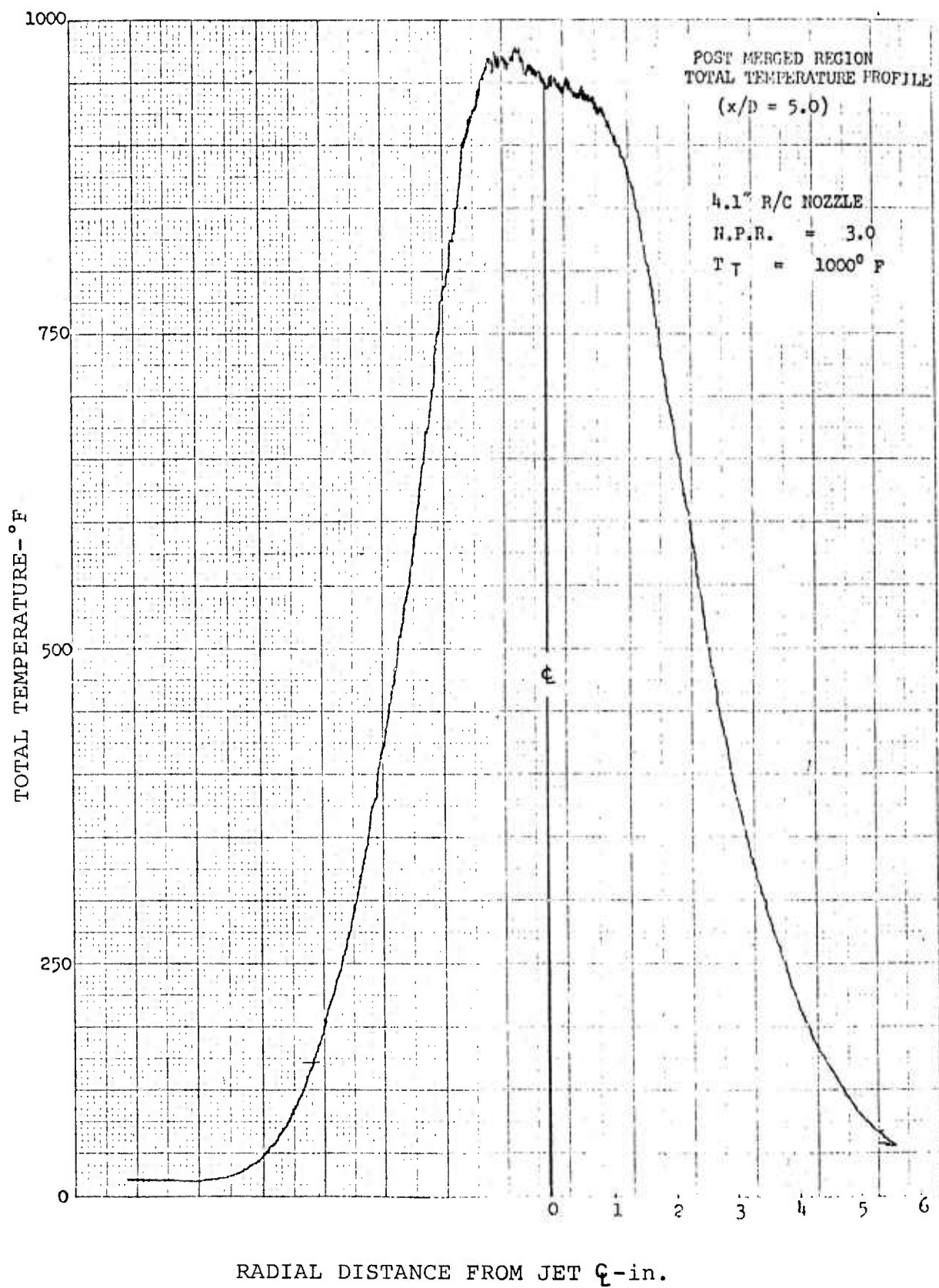


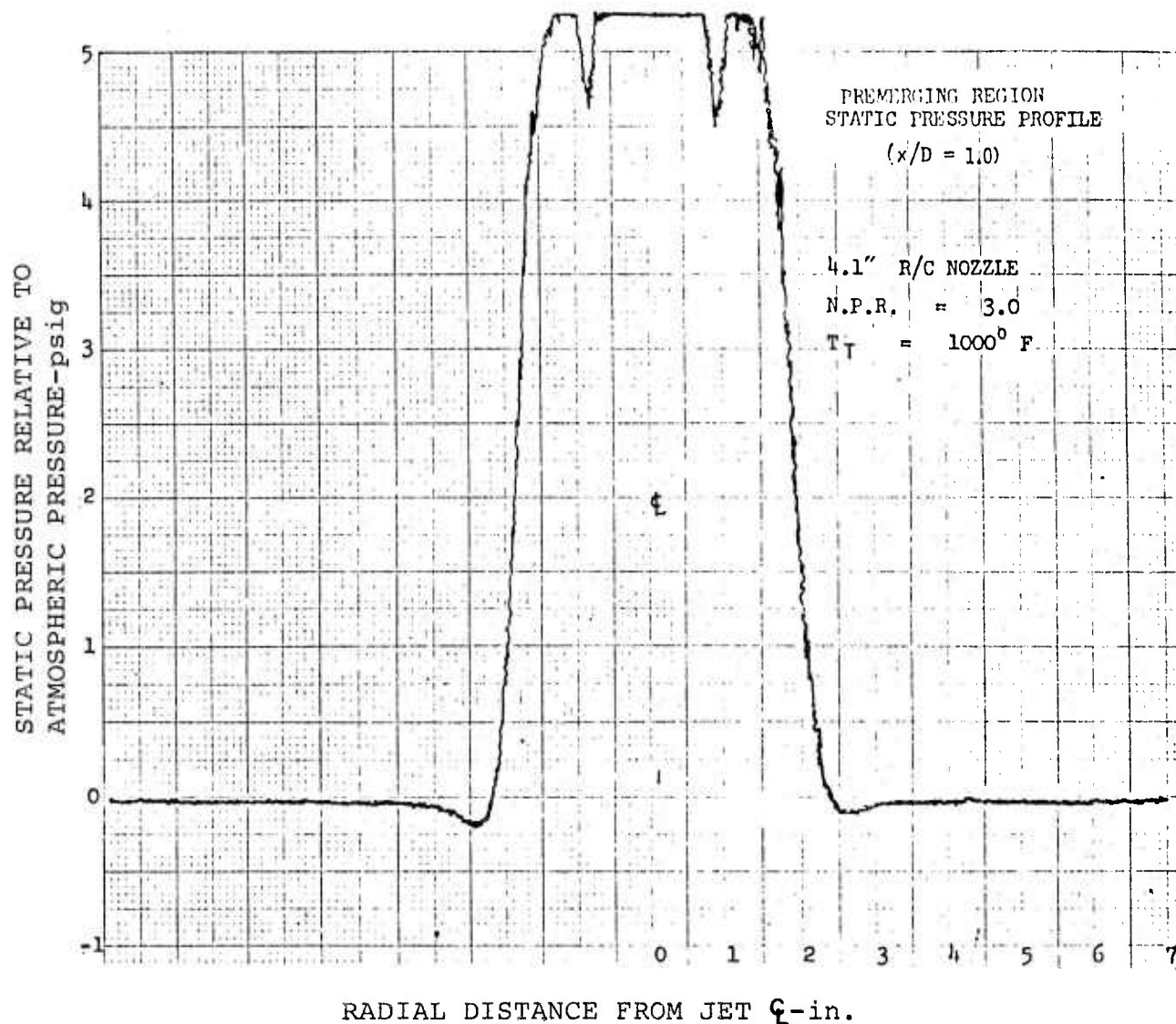
PREMERGING REGION
TOTAL PRESSURE PROFILE ($x/D = 1.0$)

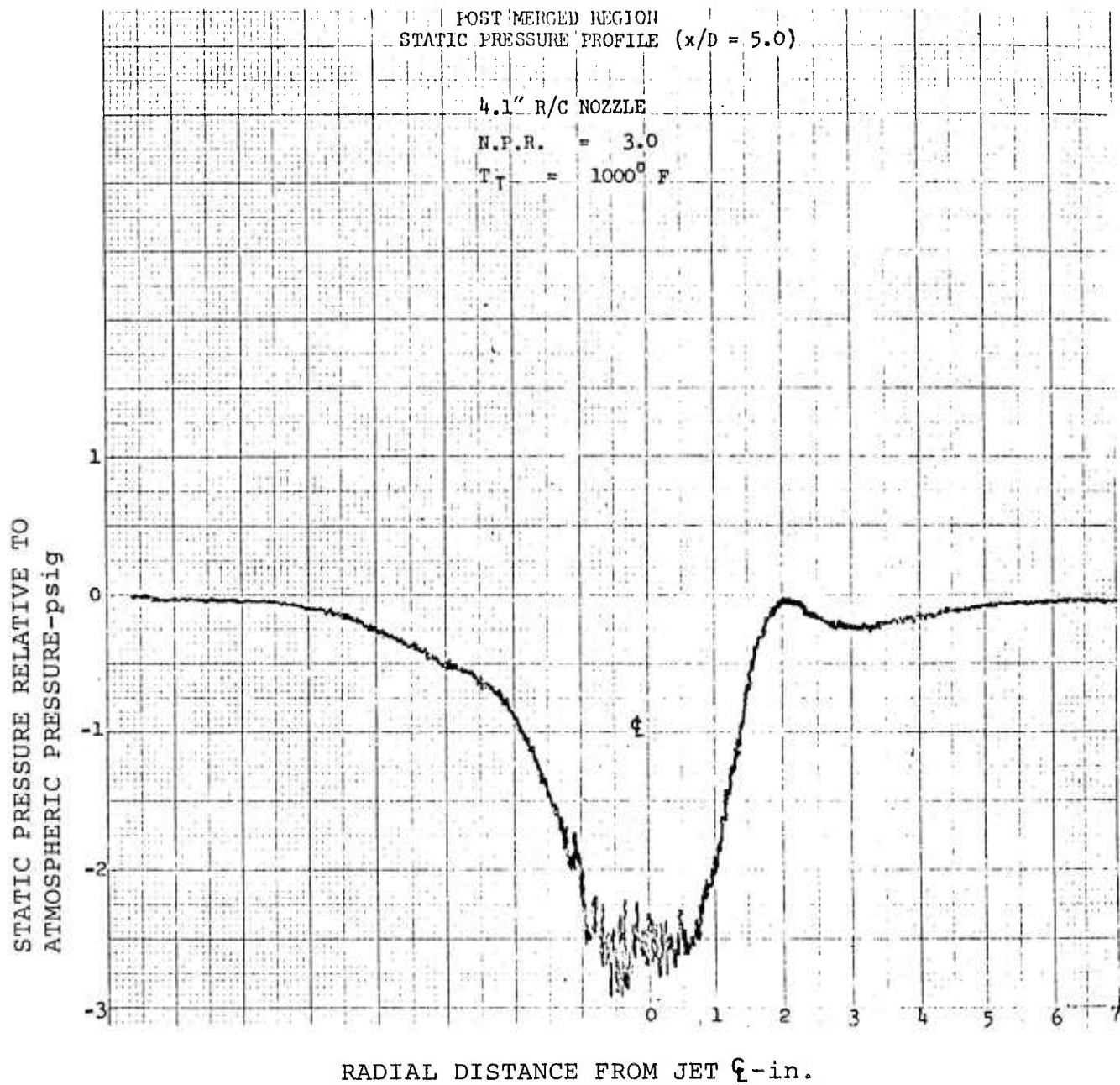












TEST CONDITIONS

NOZZLE: 6 IN. DIA. ROUND CONVERGENT

FACILITY: HNTF

DATE: 11-21-73

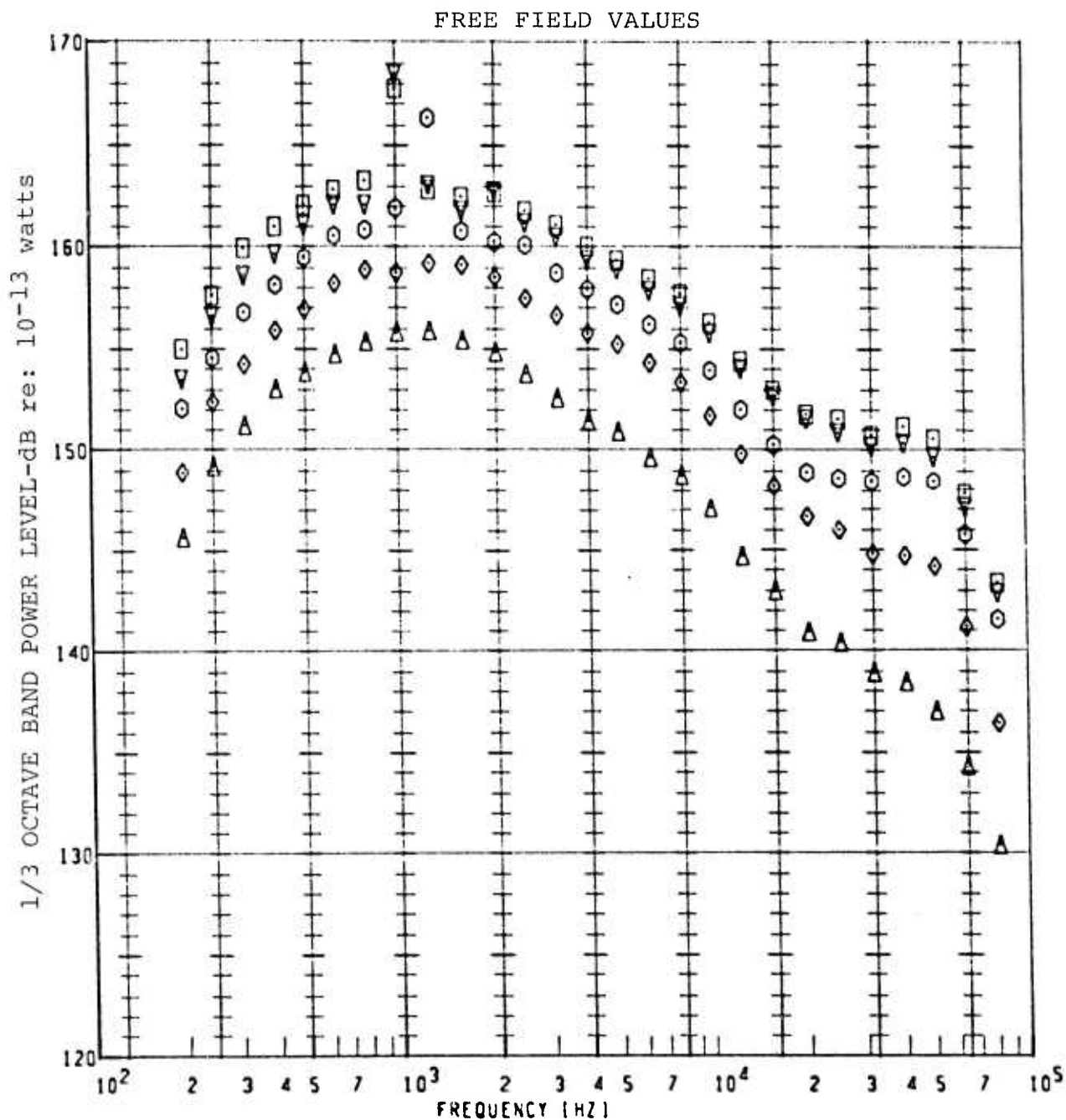
T_{AMB} =

R.H. =

SCALE MODEL A₈ =

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
03	2.0	1500°F	2072 fps	11-21-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

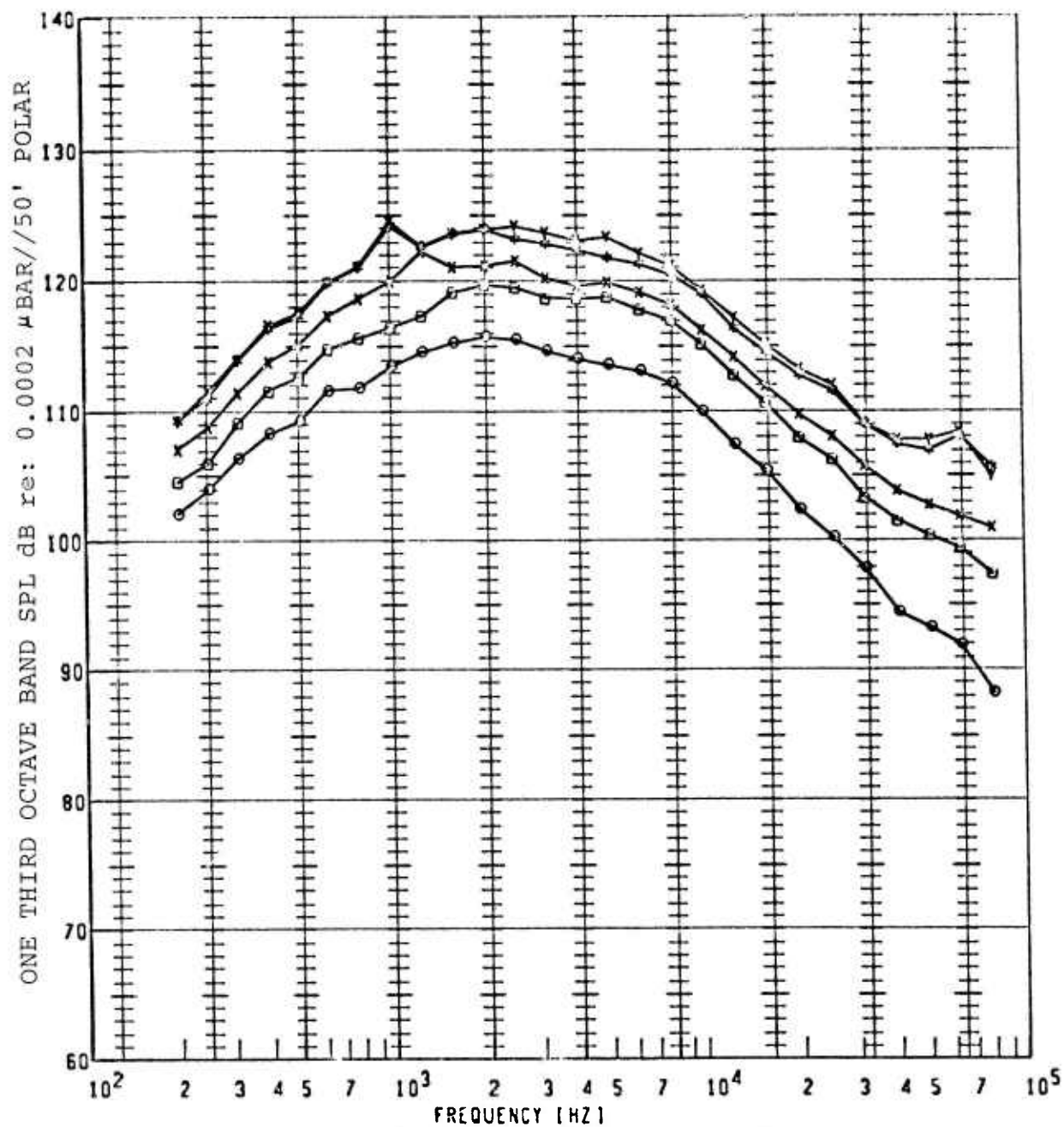
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	3	2.00	1500°F
◇	3	2.50	1500
○	3	3.00	1500
▽	3	3.50	1500
□	3	3.80	1500

NOZZLE: 6" R/C

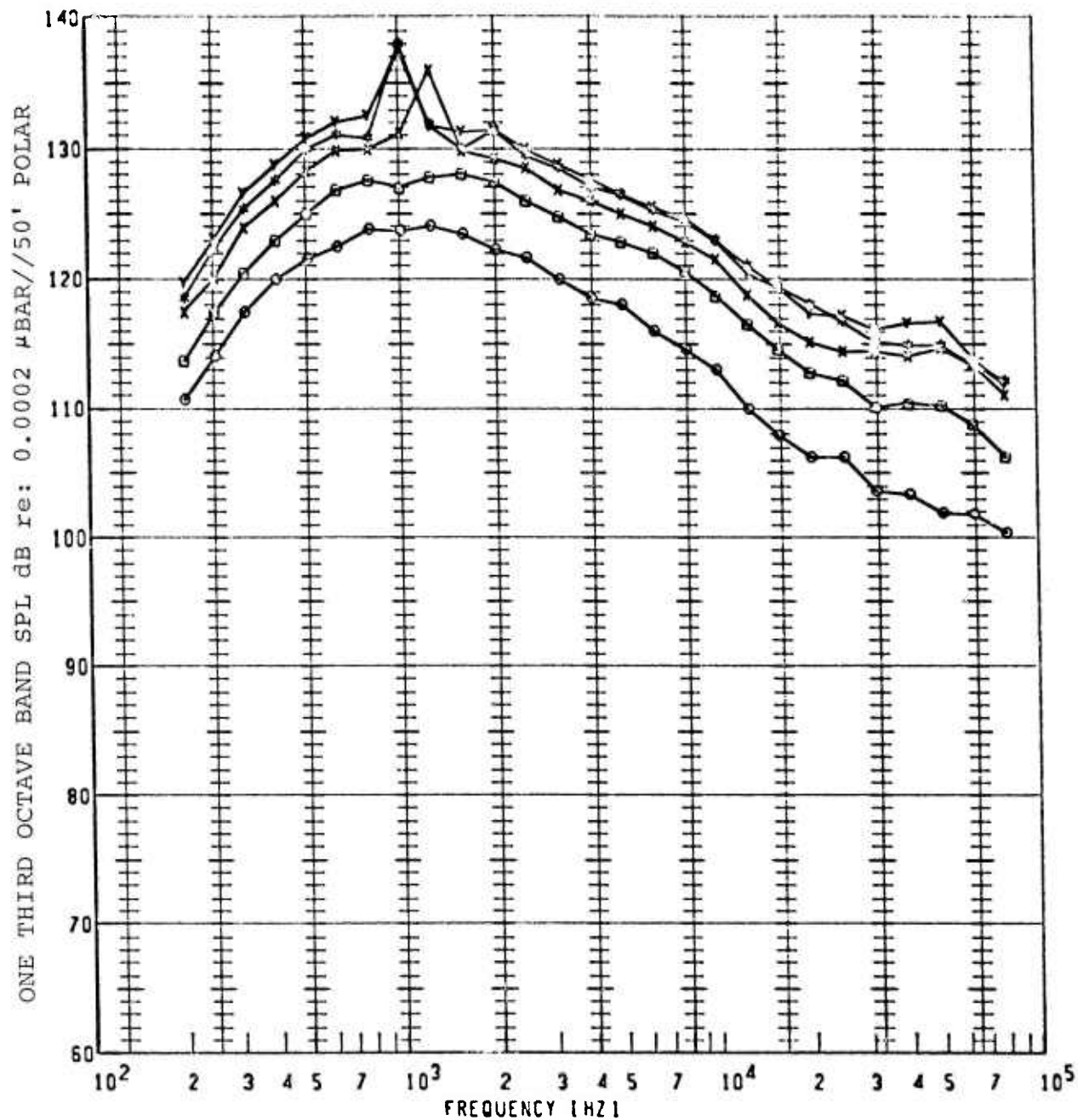
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL IDB1
○	3G	1500°F	2.000	110	50FP	125.4
□	3G	1500	2.500	110	50FP	129.5
x	3G	1500	3.000	110	50FP	131.6
*	3G	1500	3.500	110	50FP	133.9
△	3G	1500	3.800	110	50FP	134.4

NOZZLE: 6" R/C

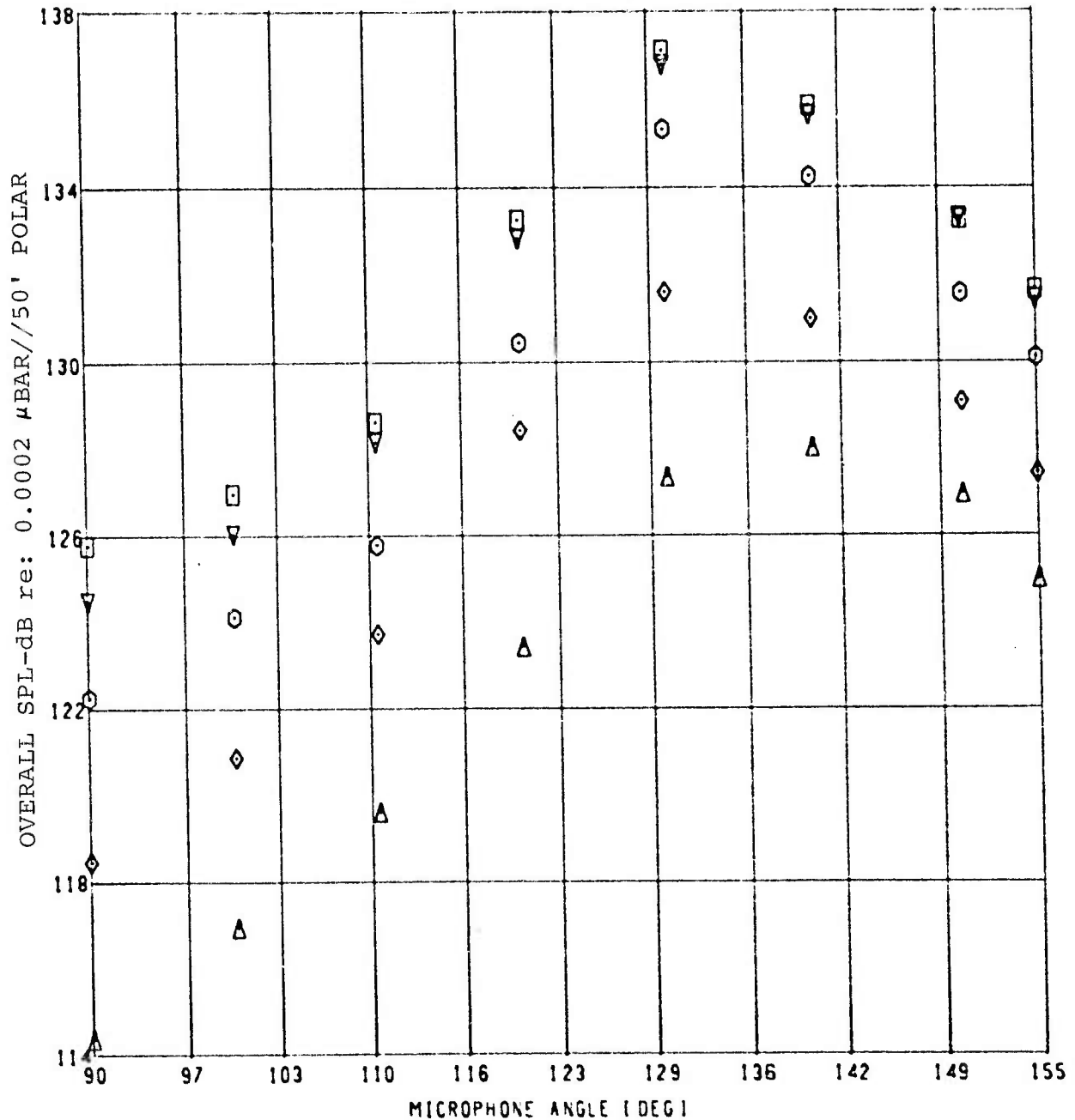
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	CASPL (CBI)
o	3G	1500°F	2.000	130	50FP	133.3
□	3G	1500	2.500	130	50FP	137.5
x	3G	1500	3.000	130	50FP	141.2
*	3G	1500	3.500	130	50FP	142.7
y	3G	1500	3.800	130	50FP	143.0

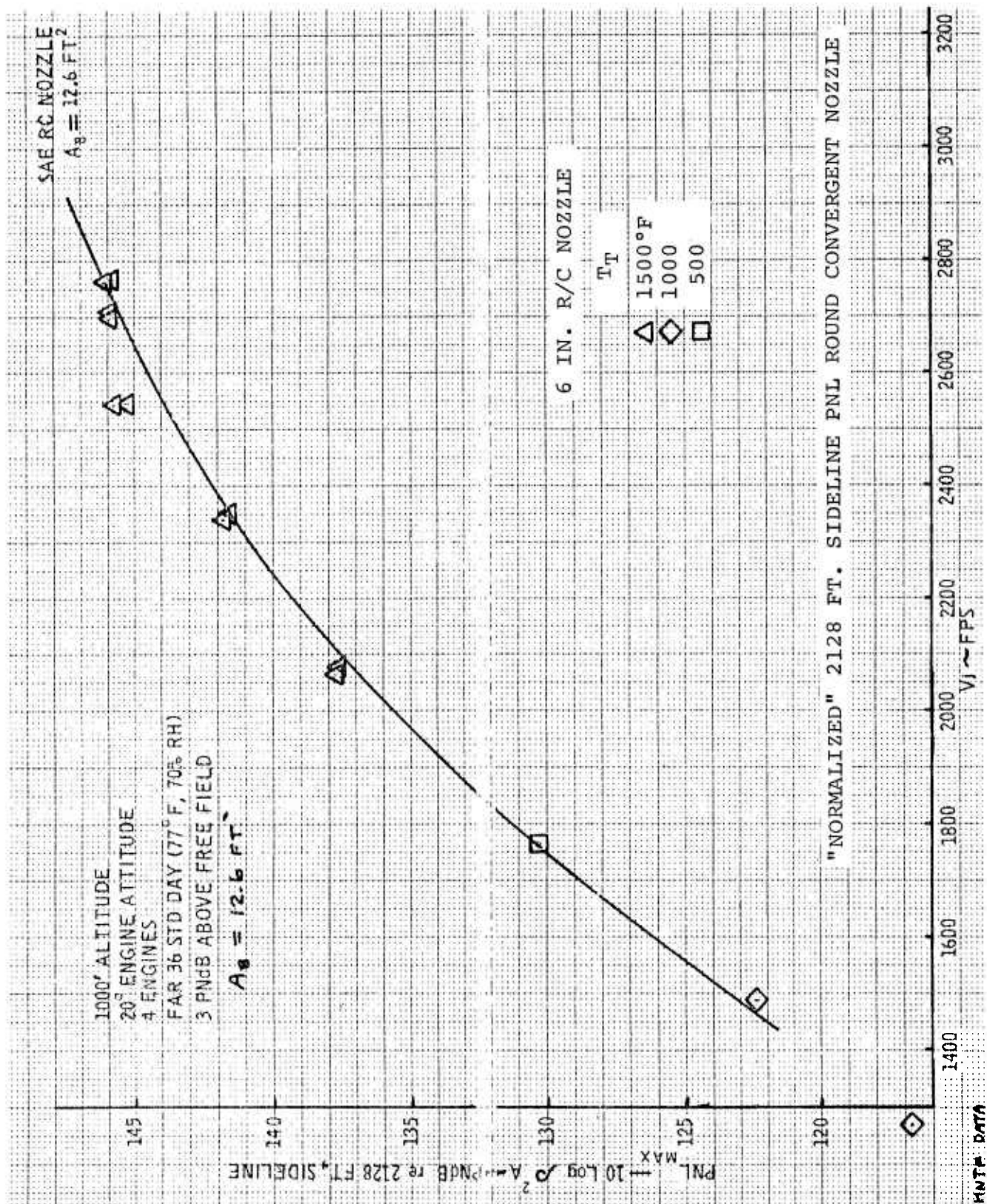
NOZZLE: 6" R/C

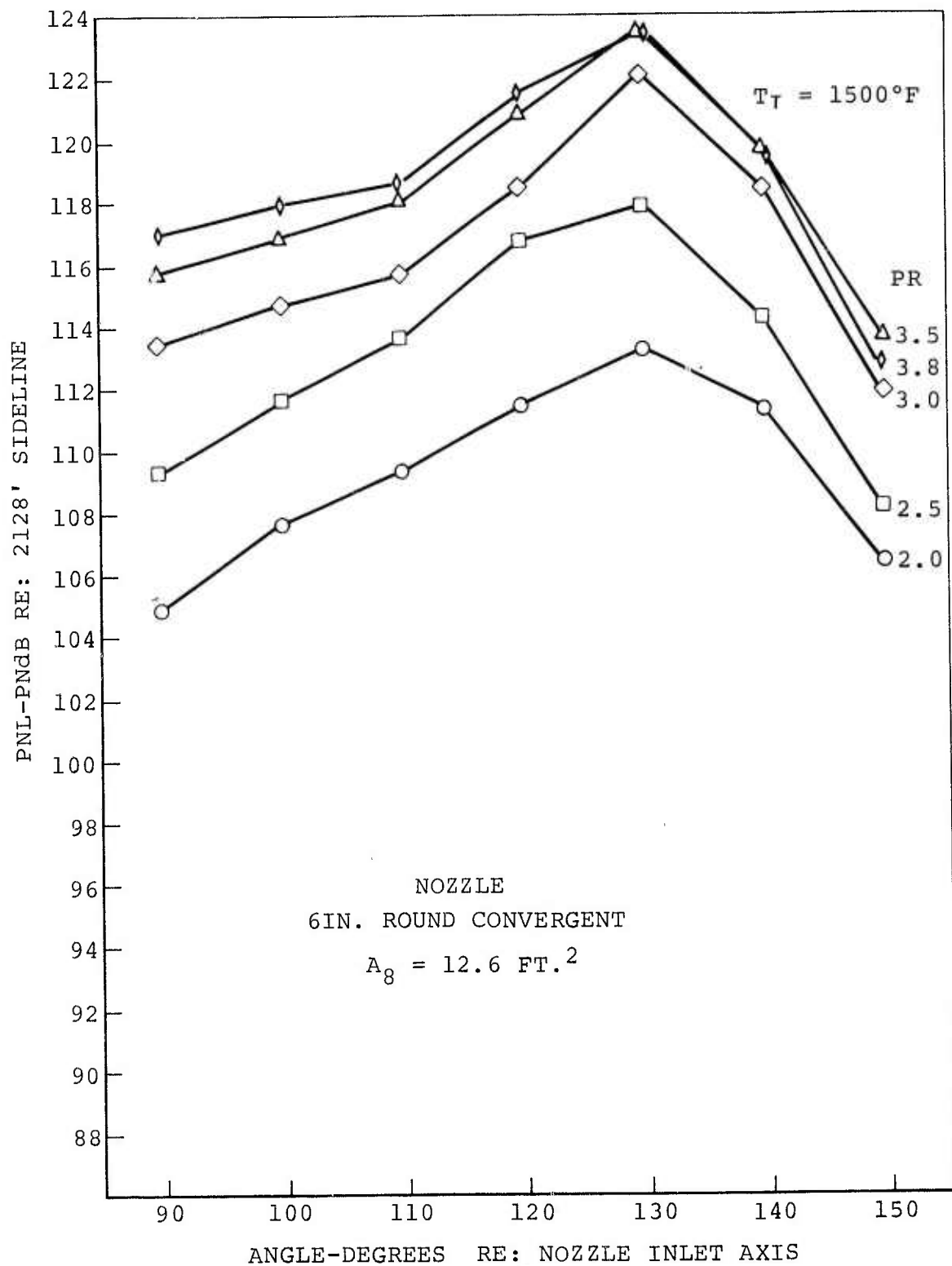
FREE FIELD VALUES



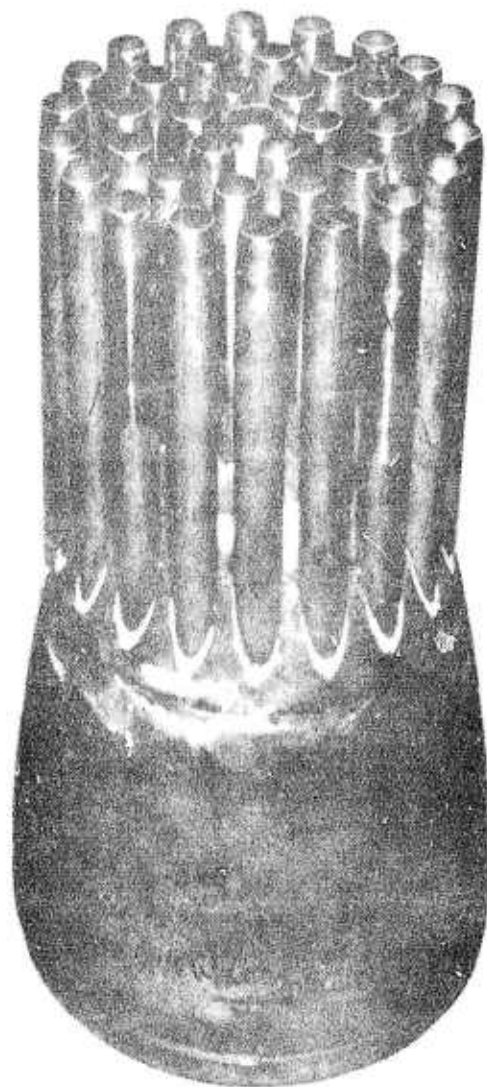
PLGT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	3	2.00	1500 °F
◆	3	2.50	1500
○	3	3.00	1500
▼	3	3.50	1500
◻	3	3.80	1500

NOZZLE: 6" R/C





ROUND CONVERGENT NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN



37TUBE, 3.3 AREA RATIO REFERENCE NOZZLE

NO
SCHEMATIC
AVAILABLE

NOZZLE EXIT PATTERN SIMILAR TO THAT SHOWN ON PAGE 109

37T-3.3AR-CPA-RT/RC NOZZLE

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-RT/RC

FACILITY: HNTF

DATE:

T_{AMB} =

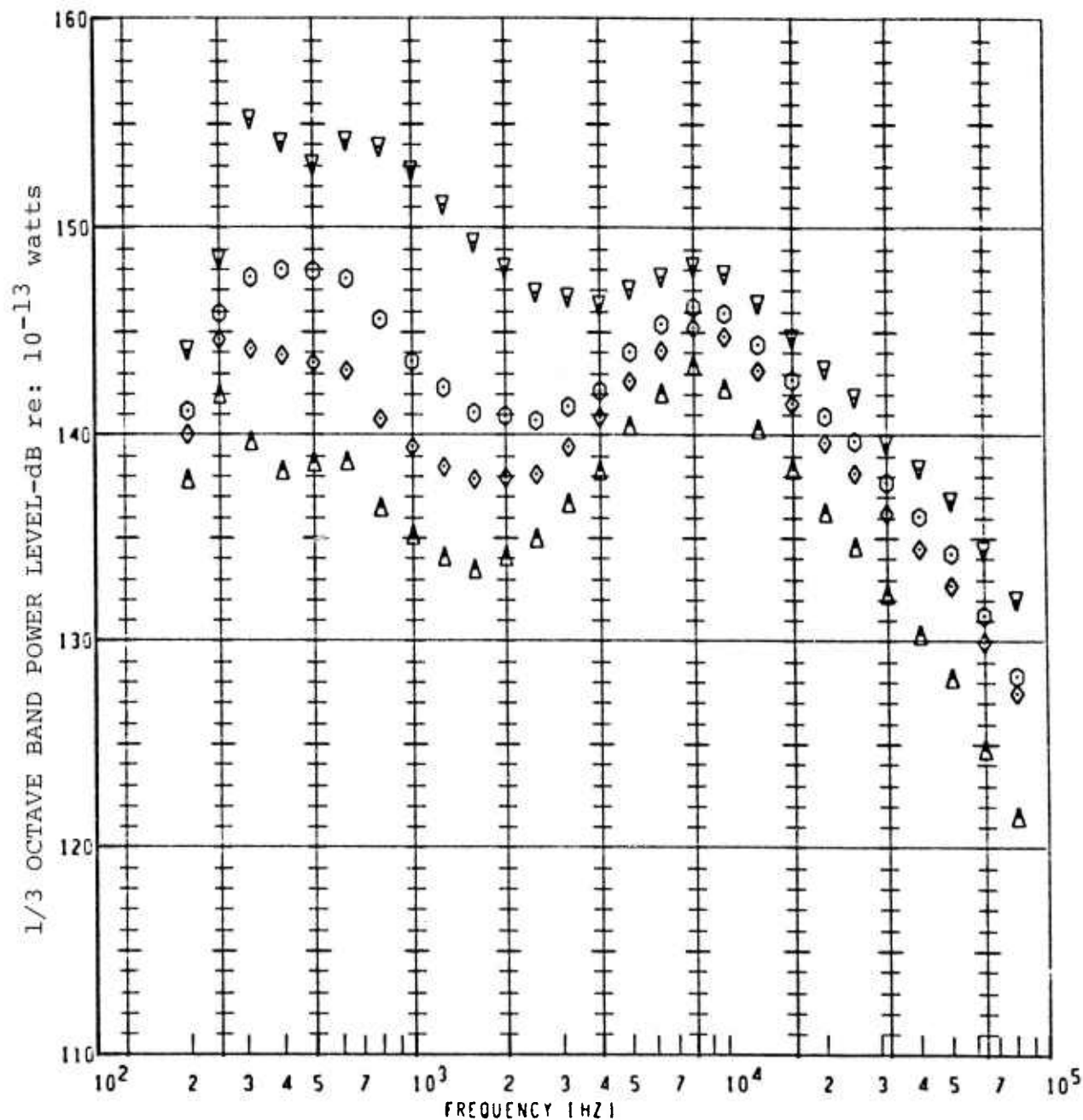
R.H. =

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
66	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES



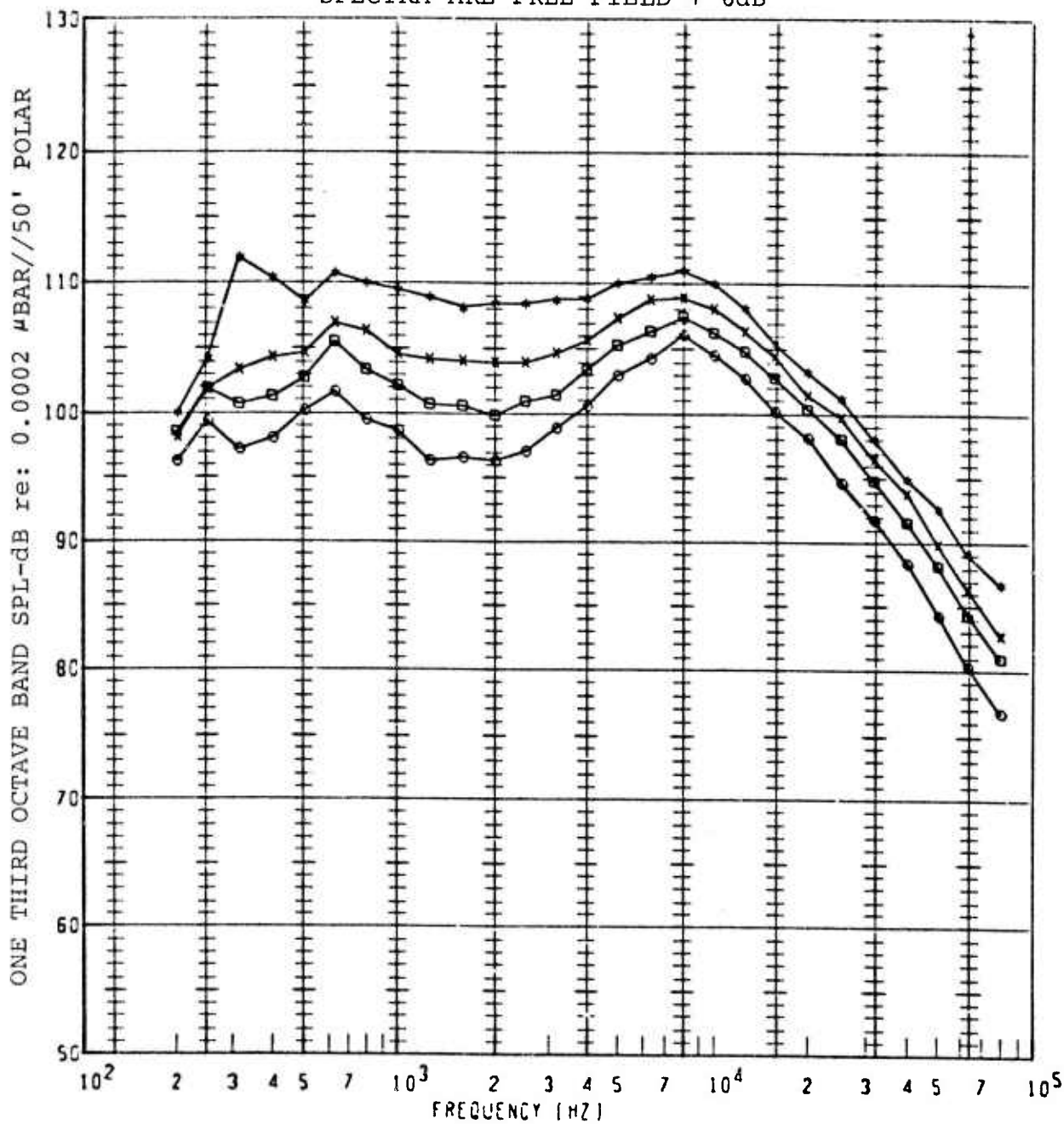
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	66	2.00	1150°F
◇	66	2.50	1150
○	66	3.00	1150
▽	66	4.00	1150

A = 13.6 IN.²

NOZZLE: 37T-3.3AR-CPA-RT/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

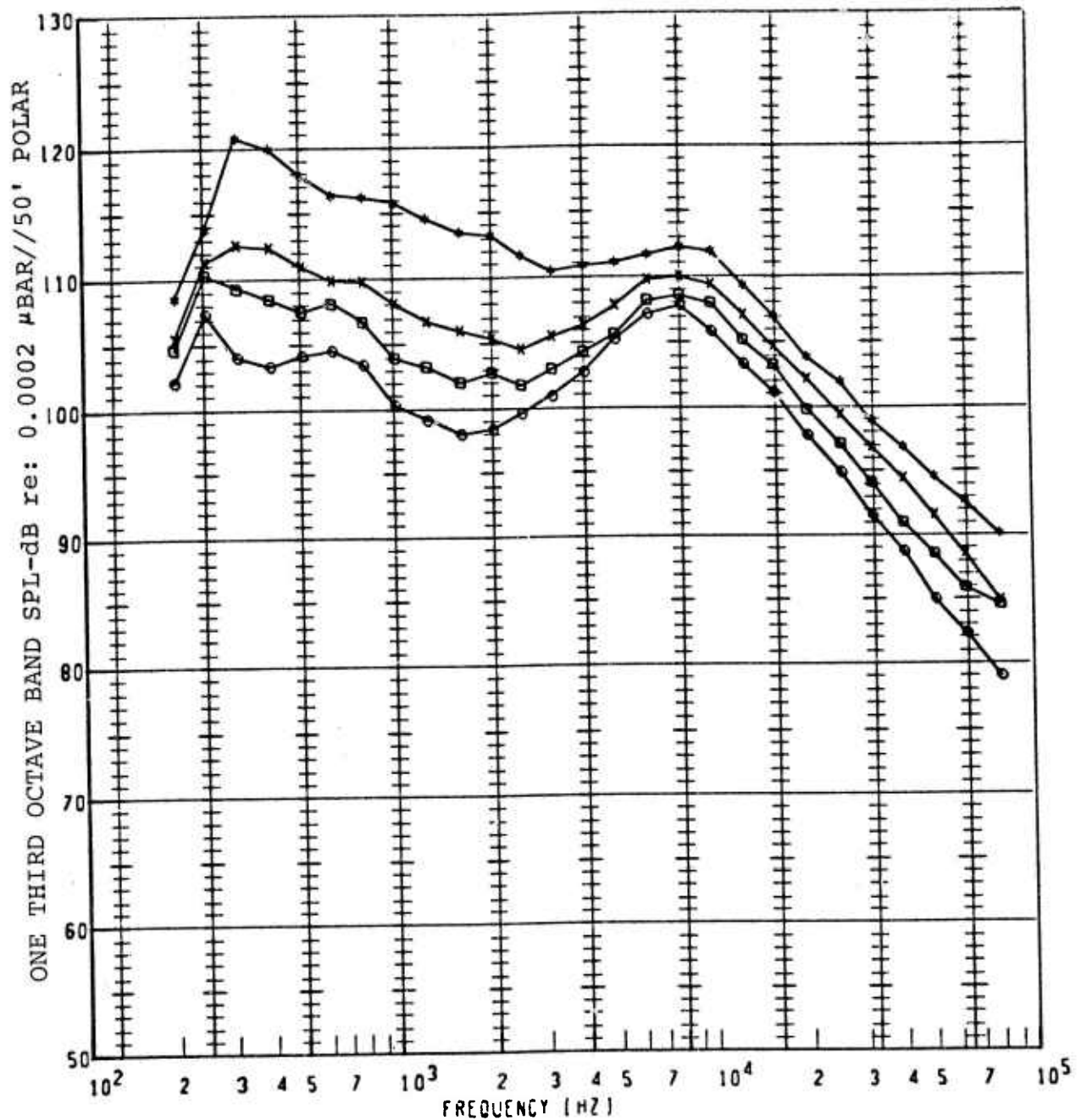


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
○	66G	1150° F	2.000	110°	50FP	114.2
◻	66G	1150	2.500	↓	50FP	116.7
x	66G	1150	3.000	↓	50FP	118.8
*	66G	1150	4.000	↓	50FP	122.3

NOZZLE: 37T-3.3AR-CPA-RT/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

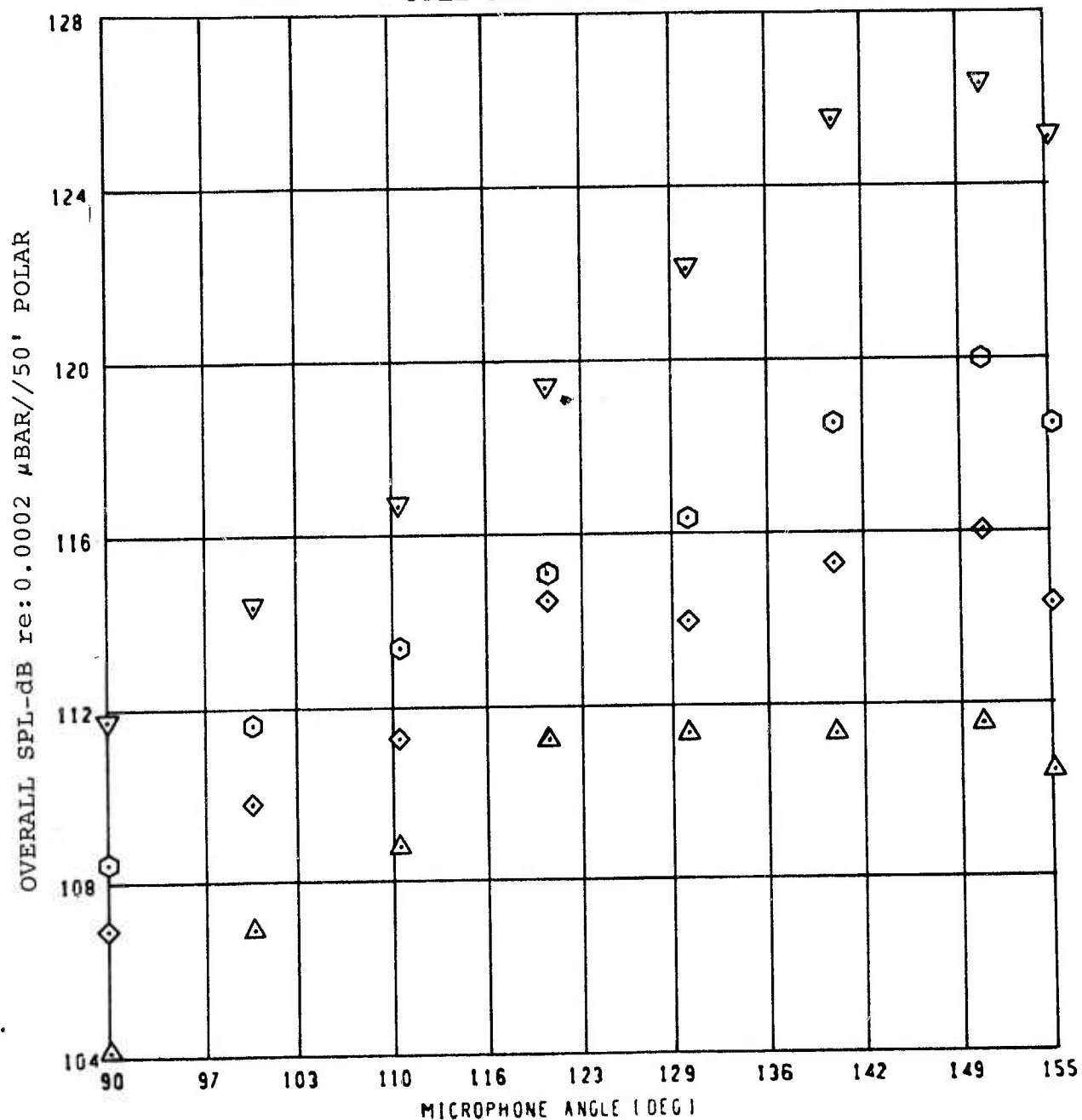


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
○	66G	1150°F	2.000	130°	50FP	117.0
◻	66G	1150	2.500	↓	50FP	119.6
x	66G	1150	3.000		50FP	122.0
*	66G	1150	4.000		50FP	127.9

NOZZLE: 37T-3.3AR-CPA-RT/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

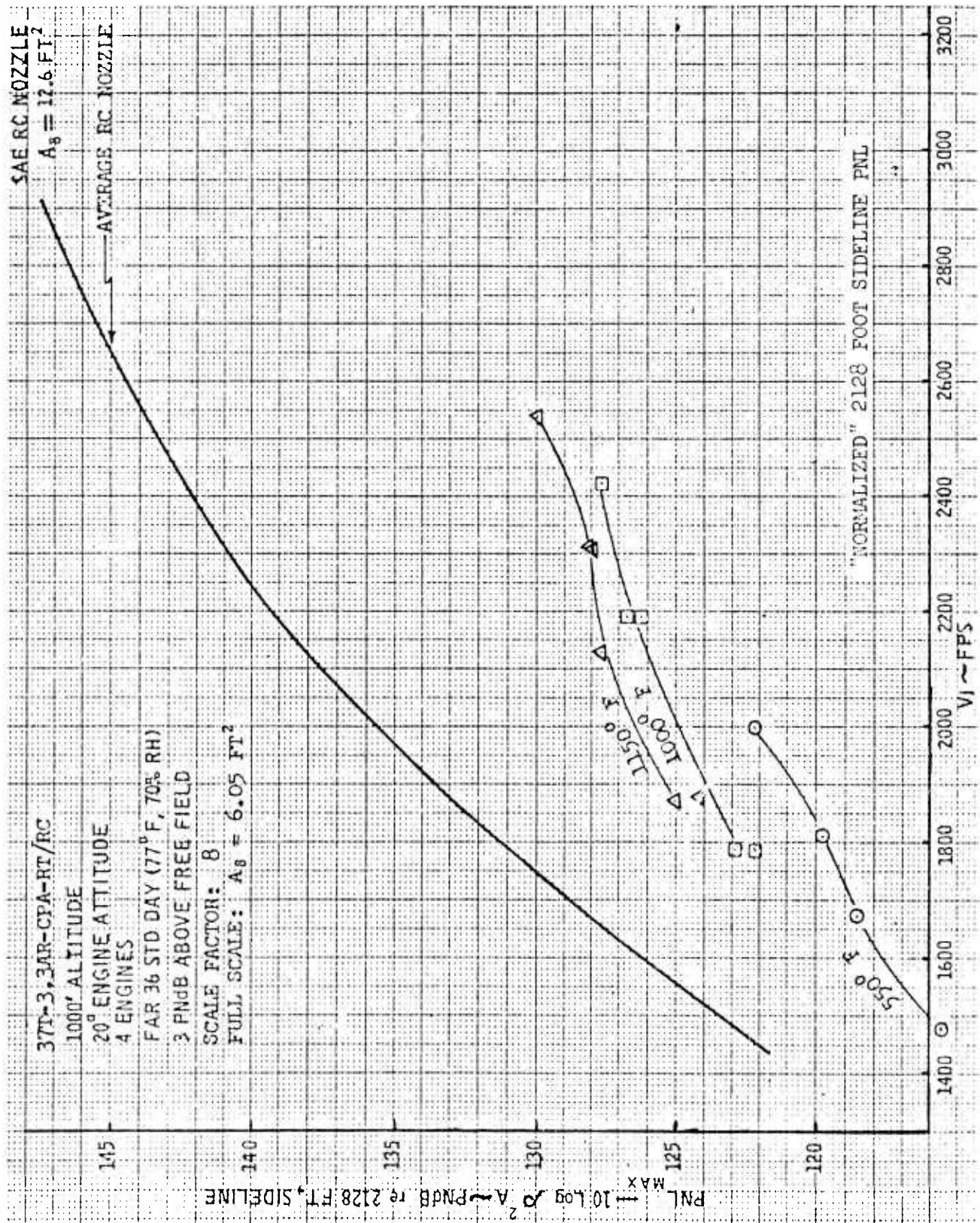
FREE FIELD VALUES



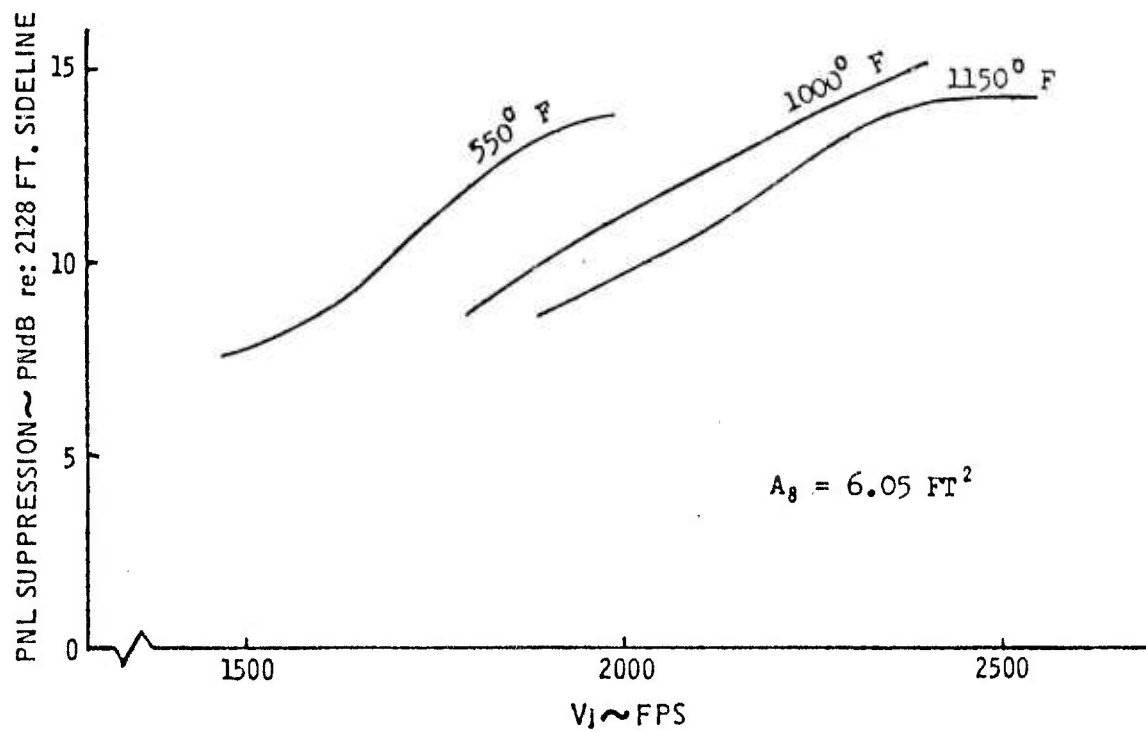
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	66	2.00	1150°F
◇	66	2.50	1150
○	66	3.00	1150
▽	66	4.00	1150

NOZZLE: 37T-3.3AR-CPA-RT/RC

OASPL BEAM PATTERNS

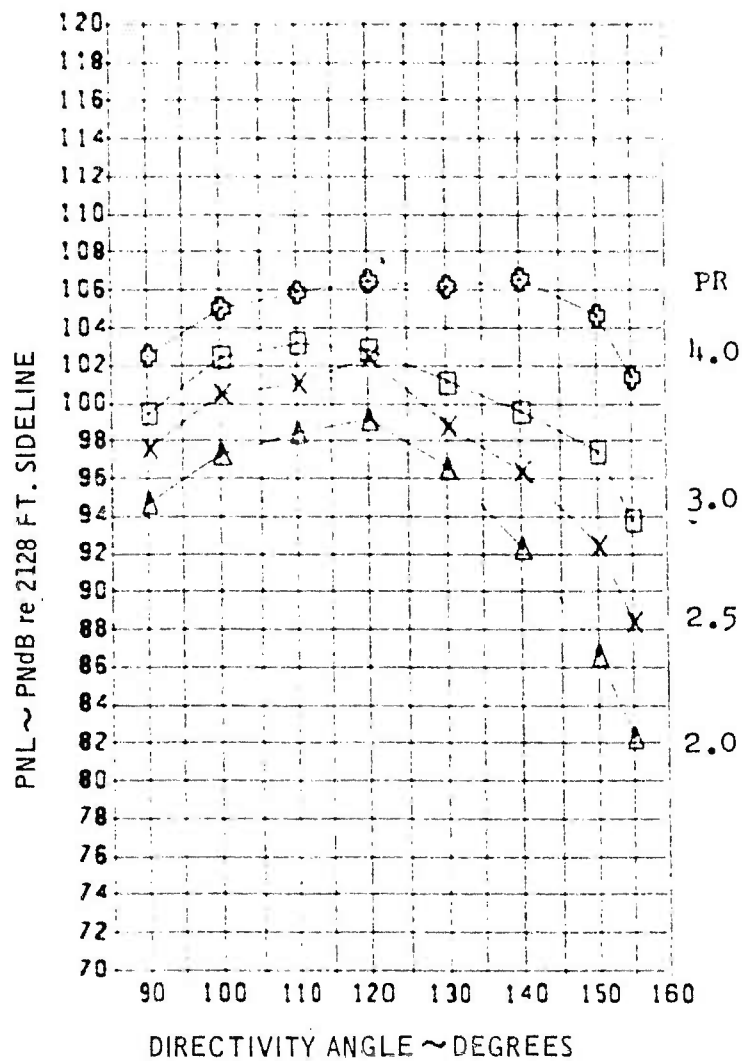


37T-3.3AR-CPA-RT/RC



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-3.3AR-CPA-RT/RC



Tt = 1150°F

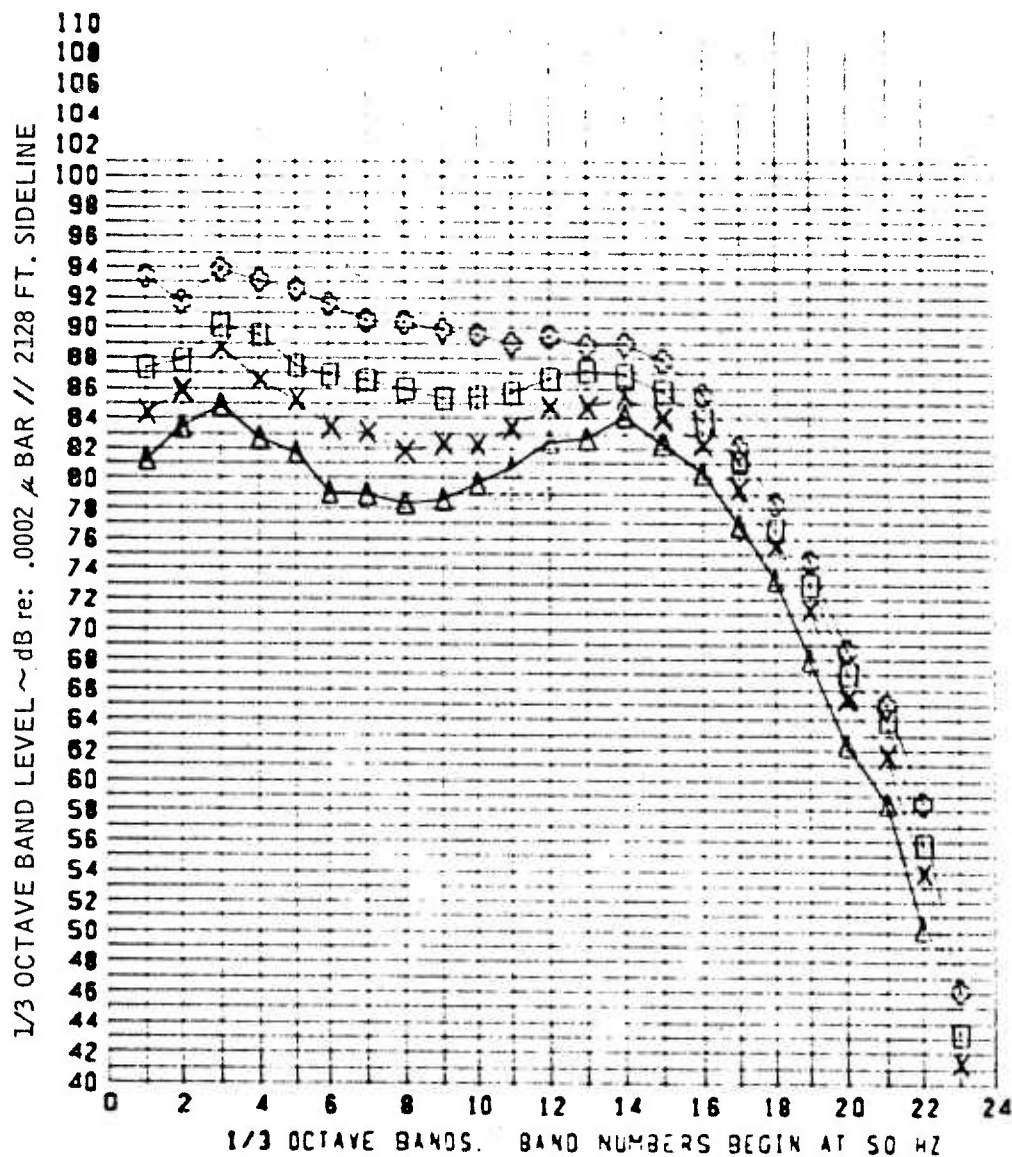
A8 = 6.05 FT²

RUN:66

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, SIDELINE = 2128 FT, 4 ENGINES

ANGLE: 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



$T_T = 1150^\circ \text{F}$

$A_8 = 6.05 \text{ FT}^2$

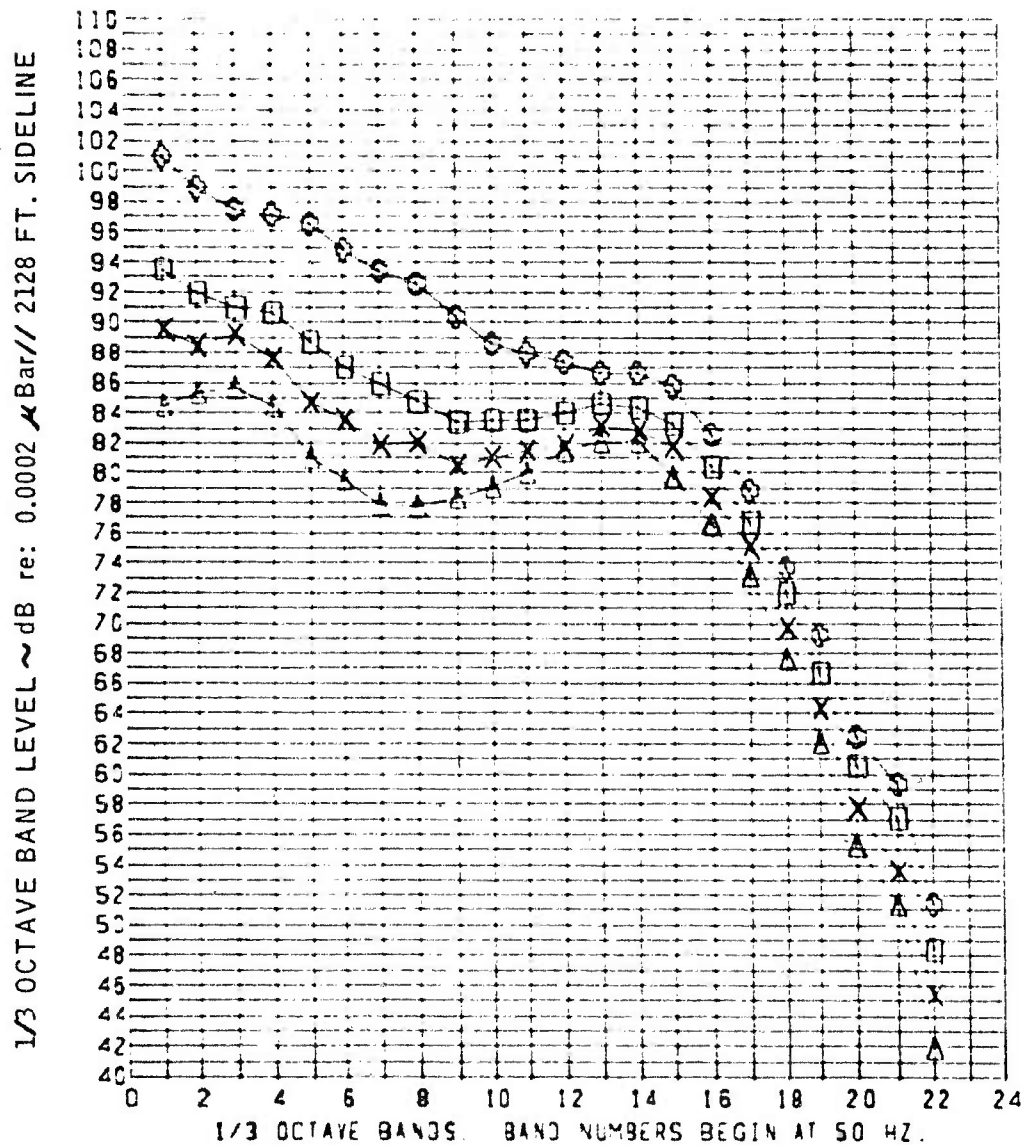
RUN: 66

PR Δ 2.0, \times 2.5, \square 3.0, \diamond 4.0

NOZZLE: 37T-3.3AR-CPA-RT/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000FT, VEL = 0 FPS, S.L. = 2128 FT., 4 ENGINES
 ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



TT = 1150°F

A₈ = 6.05 FT²

RUN: 66

PR = Δ 2.0, \times 2.5, \square 3.0, \diamond 4.0

NOZZLE: 37T-3.3AR-CPA-RT/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130° re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-RT/RC

FACILITY: WALL ISOLATION FACILITY

DATE: August 25, 1972

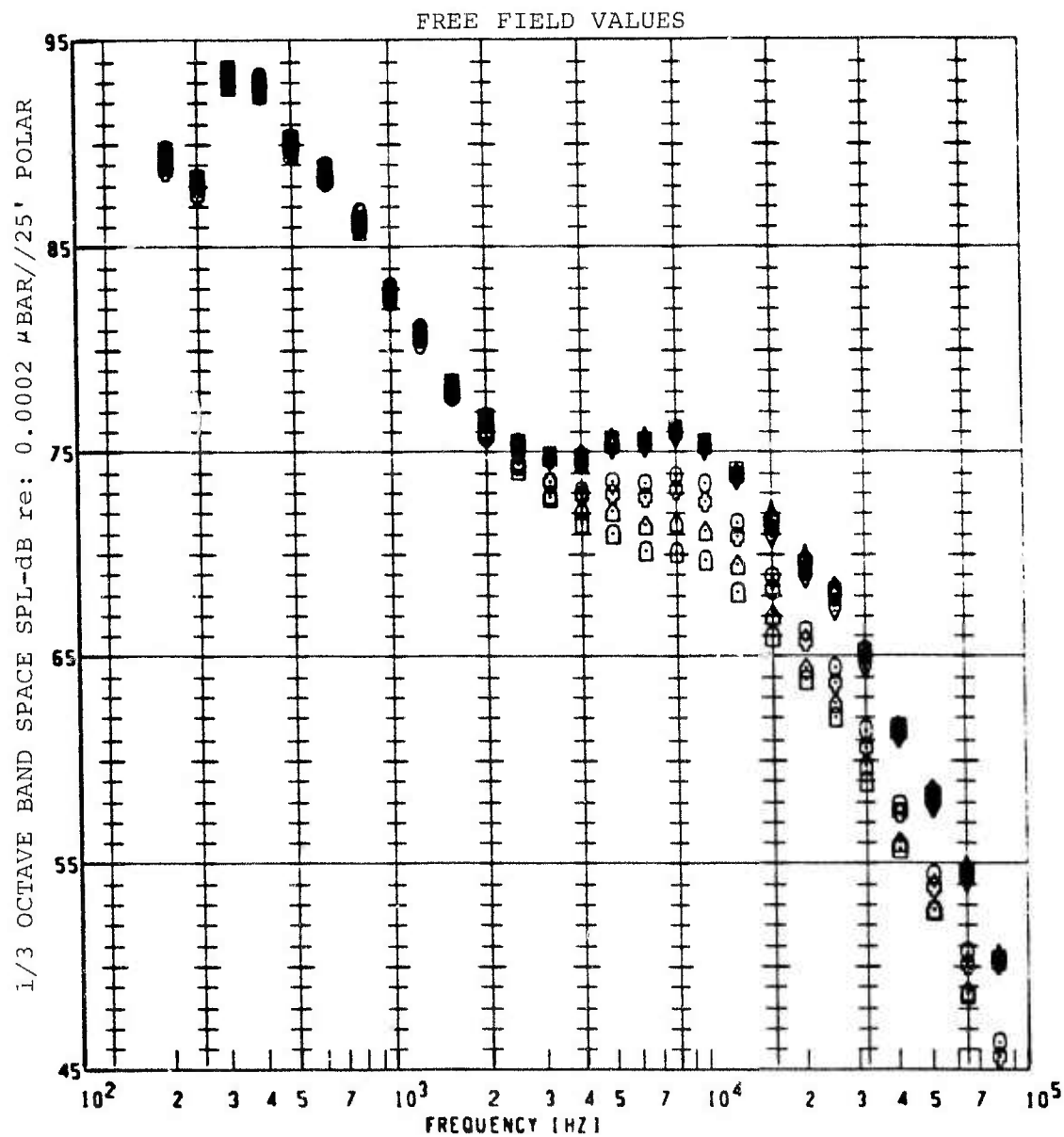
P_{AMB} = 30.05 in Hg **T_{AMB}** = 61°F **R.H.** = 82%

NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
206	0.0 x/D	14.3 in.		
207	0.25	11.3		
208	0.50	11.8		
209	0.75	11.8		
210	1.0	12.3		
211	1.25	11.5		
212	1.50	11.8		
213	1.75	12.0		
214	2.0	12.3		
215	2.25	12.5		
216	2.5	12.8		
217	2.75	13.0		
218	3.0	13.3		
219	3.5	13.5		
220	4.0	14.0		
221	5.0	15.0		
222	6.0	16.0		
223	8.0	18.0		
224	10.0	20.0		
225	12.0	22.0		
226	14.0	23.0		
227	16.0	25.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC



PLOT
SYMBOL

RUN
NUMBER

JET
TEMP
1150°F

PRESSURE
RATIO

AXIAL
LOCATION, x/D

△
◇
○
▽
□
◊
⊙
⊗
⊠
⊡

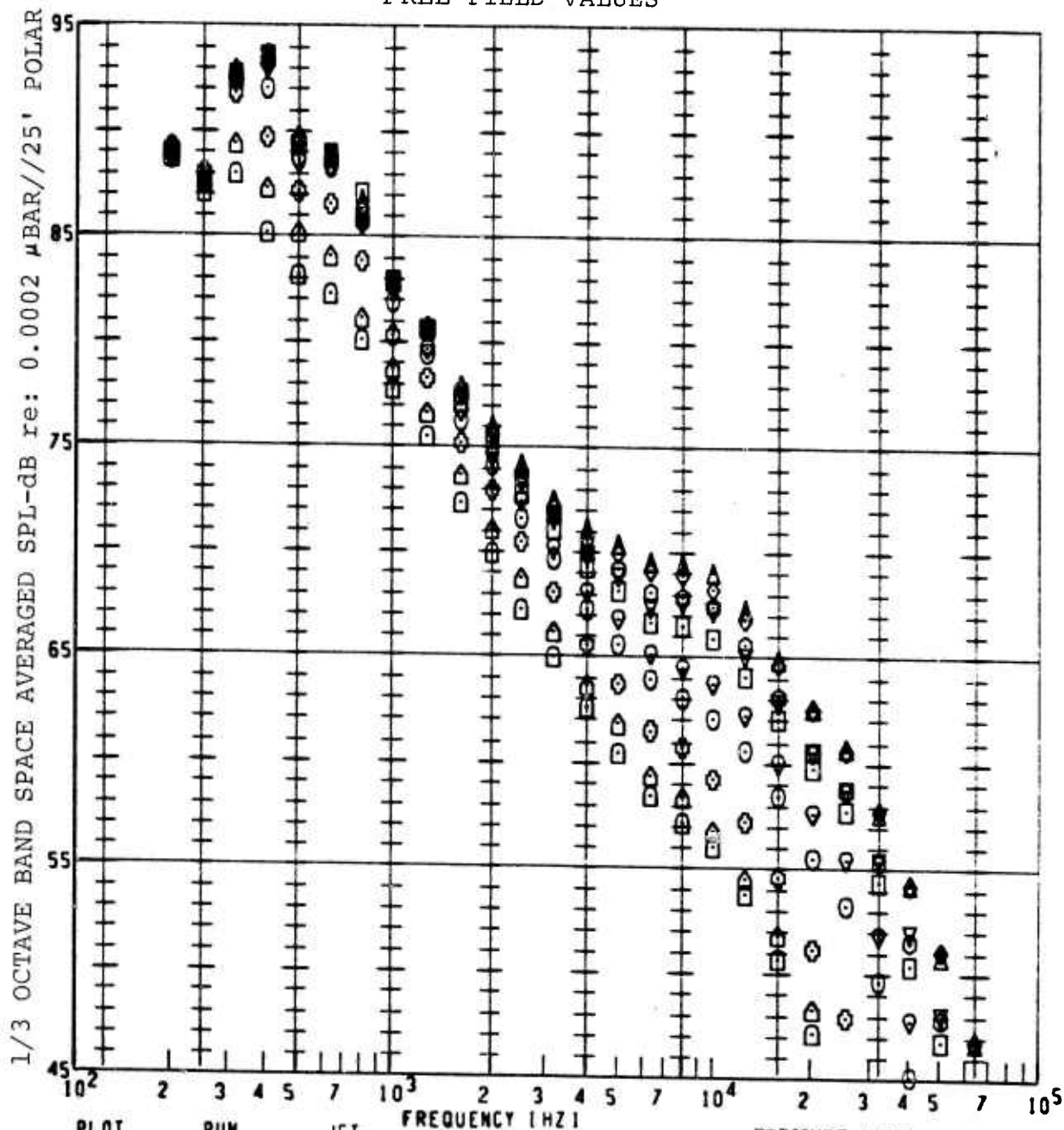
206
207
208
209
210
211
212
213
214
215

↓

3.0
↓

0.0
0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
2.25

FREE FIELD VALUES



PLOT SYMBOL

▲
◆
○
▽
□
◊
◇
△
◻

RUN NUMBER

216
217
218
219
220
221
222
223
224
225

JET TEMP

1150°F



FREQUENCY (HZ)

PRESSURE RATIO

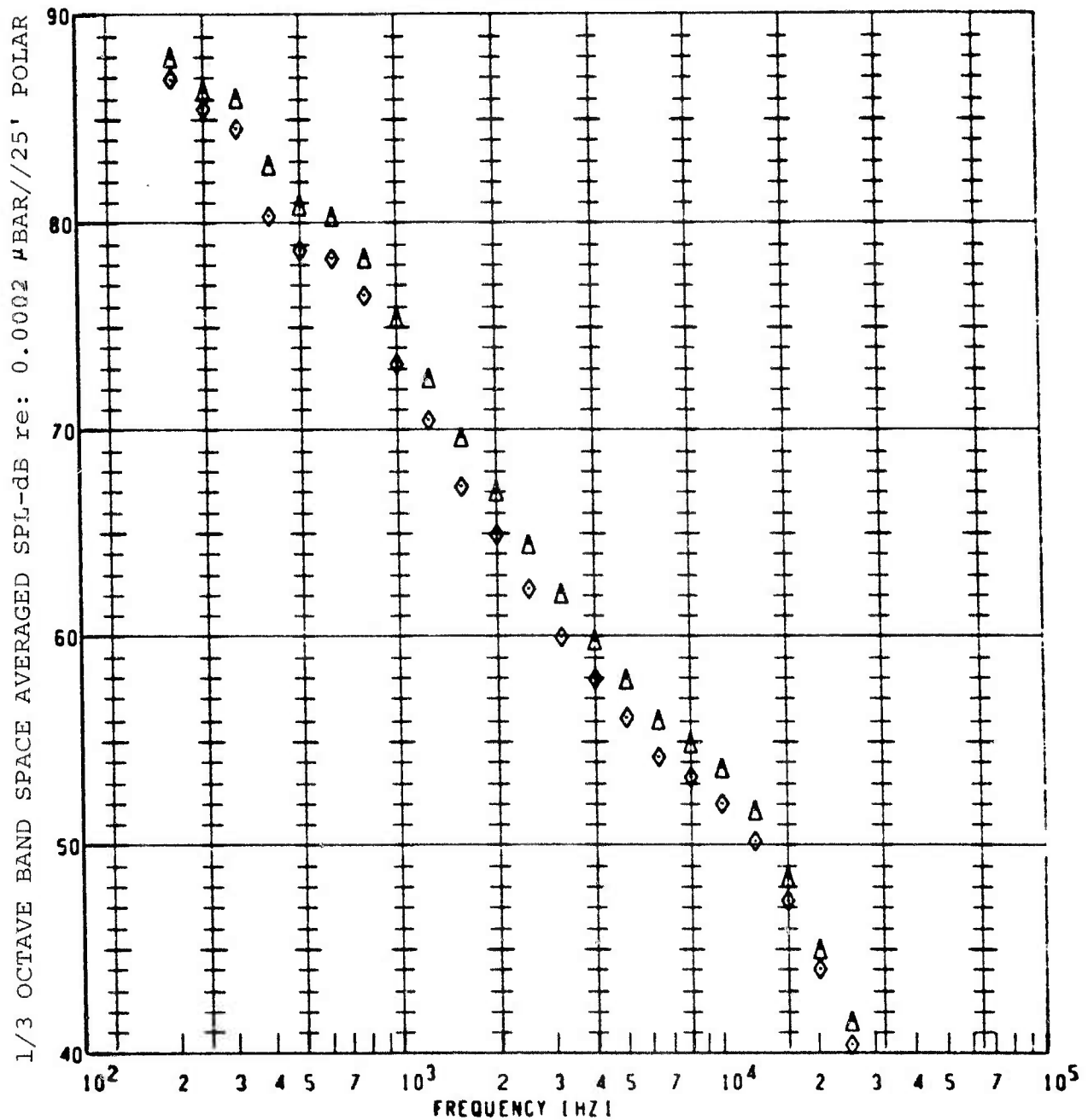
3.0



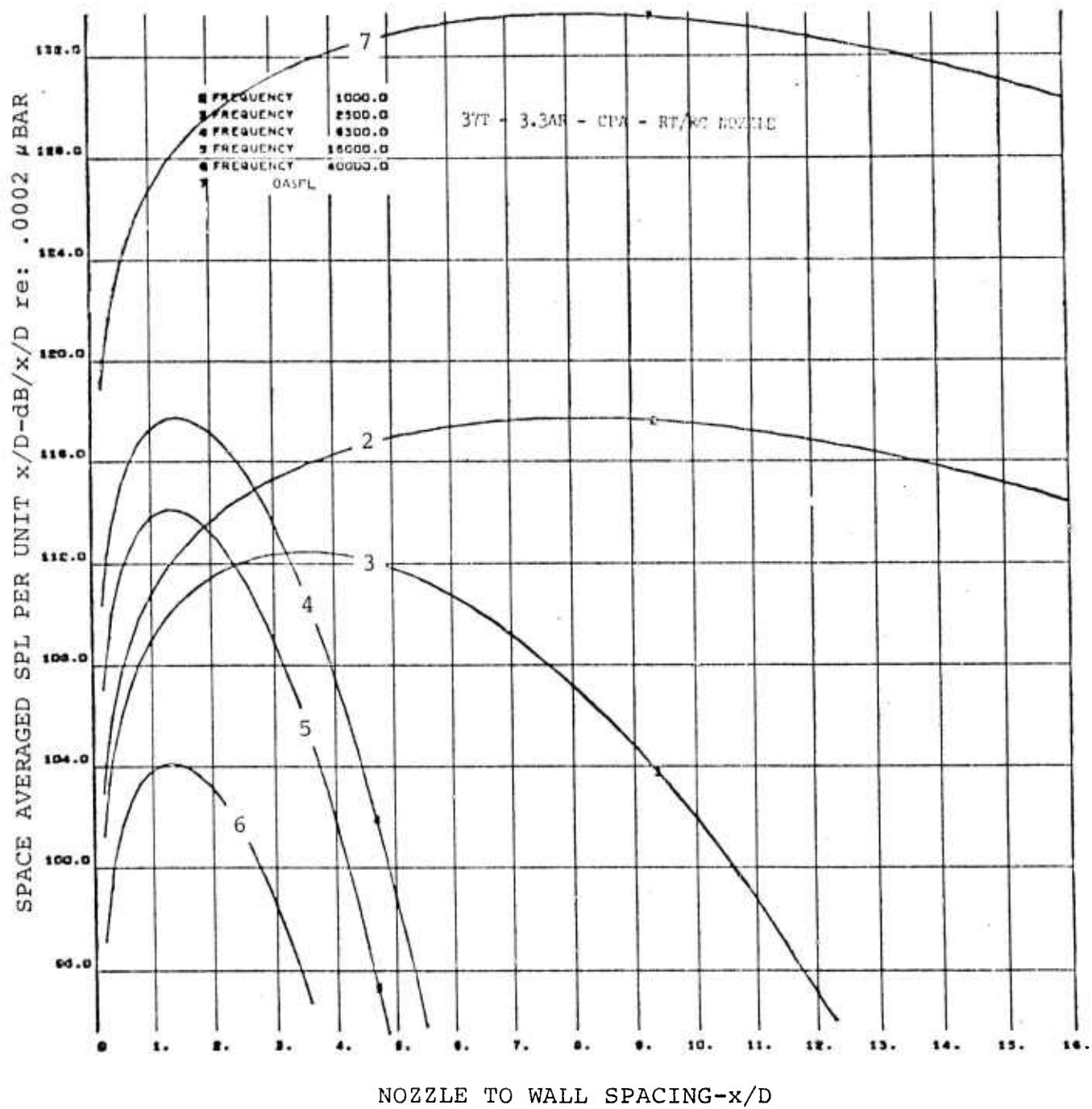
AXIAL LOCATION, x/D

2.5
2.75
3.0
3.5
4.0
5.0
6.0
8.0
10.0
12.0

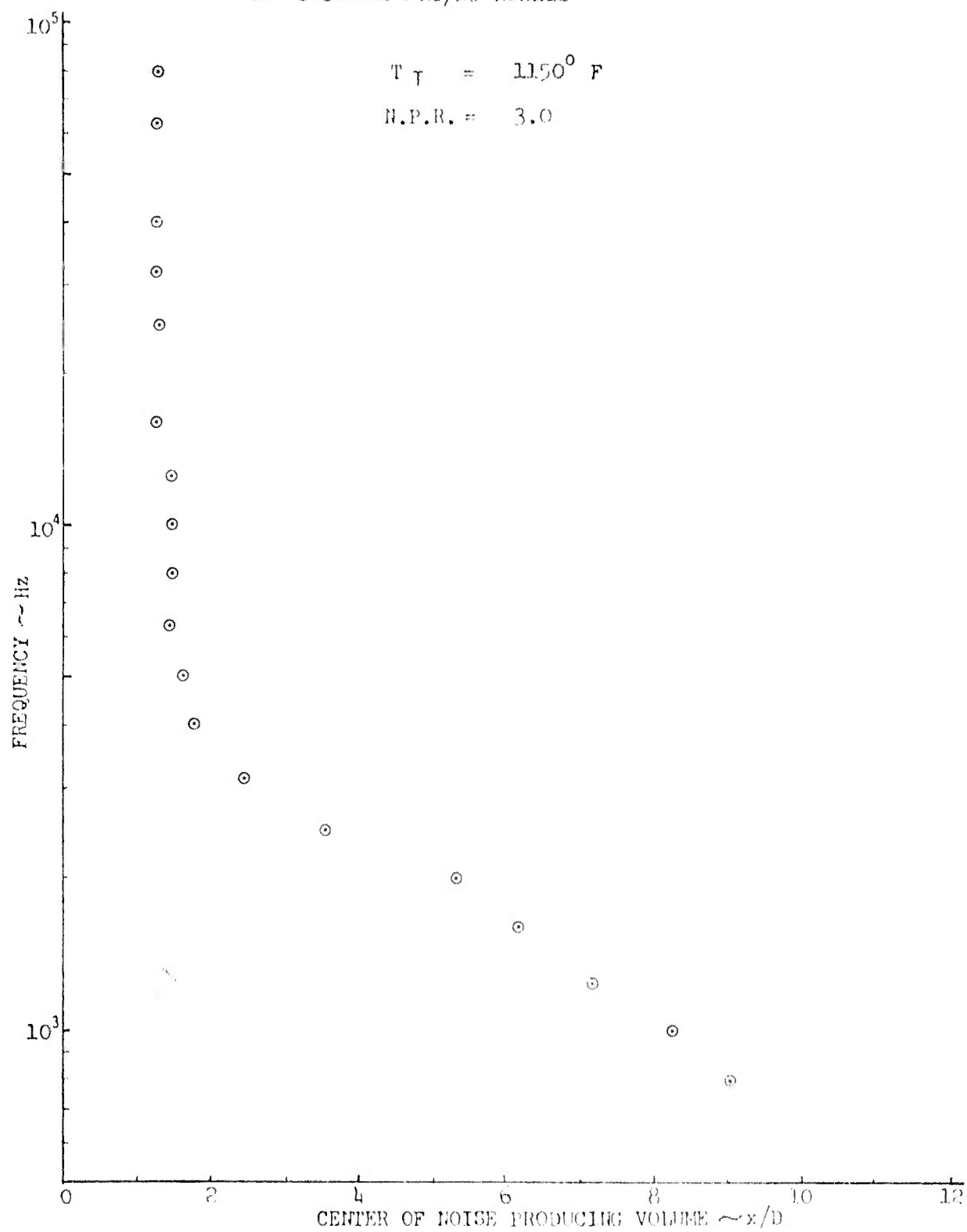
FREE FIELD VALUES



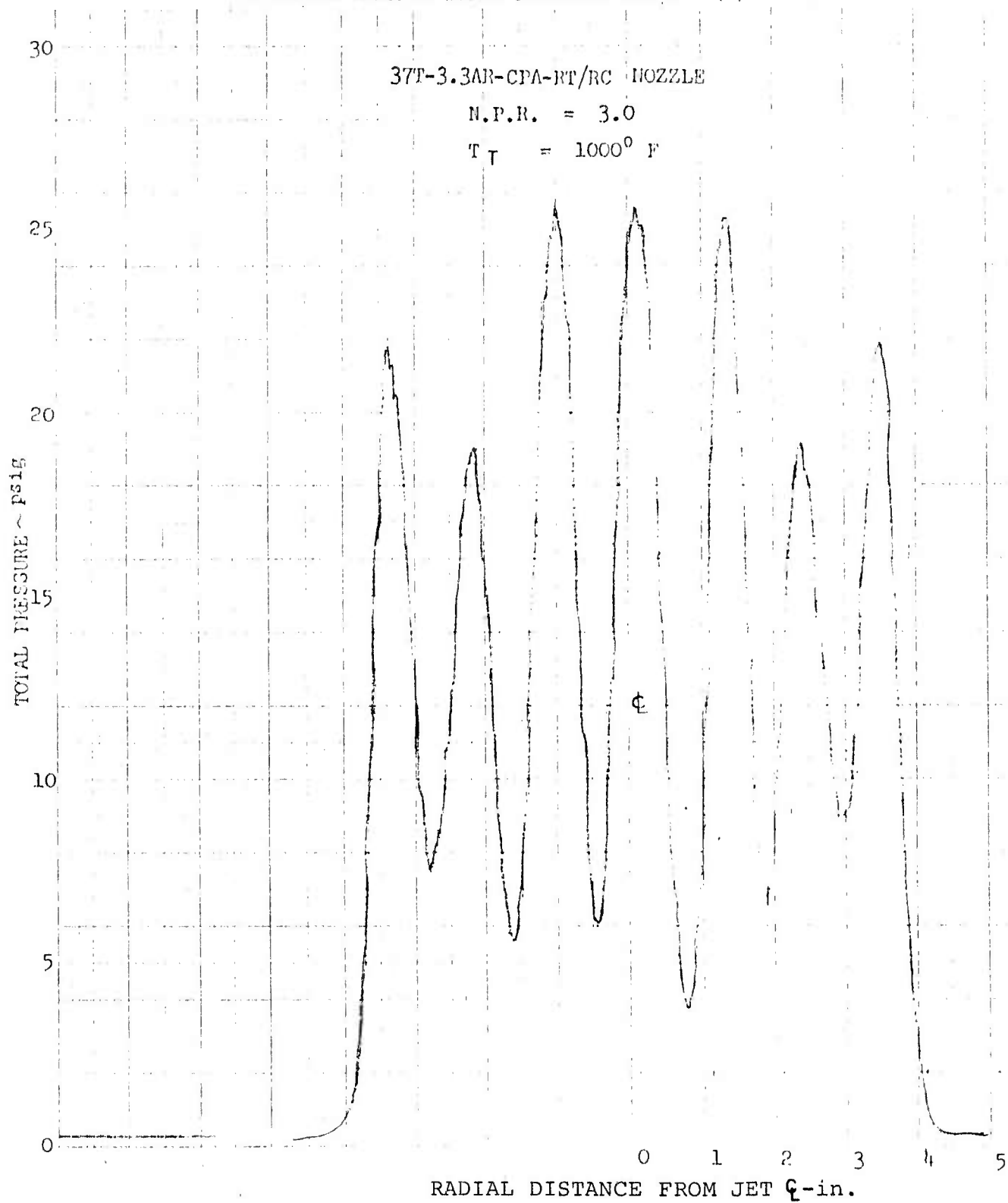
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	226	1150 °F	3.0	14.0
◊	227	1150	3.0	16.0

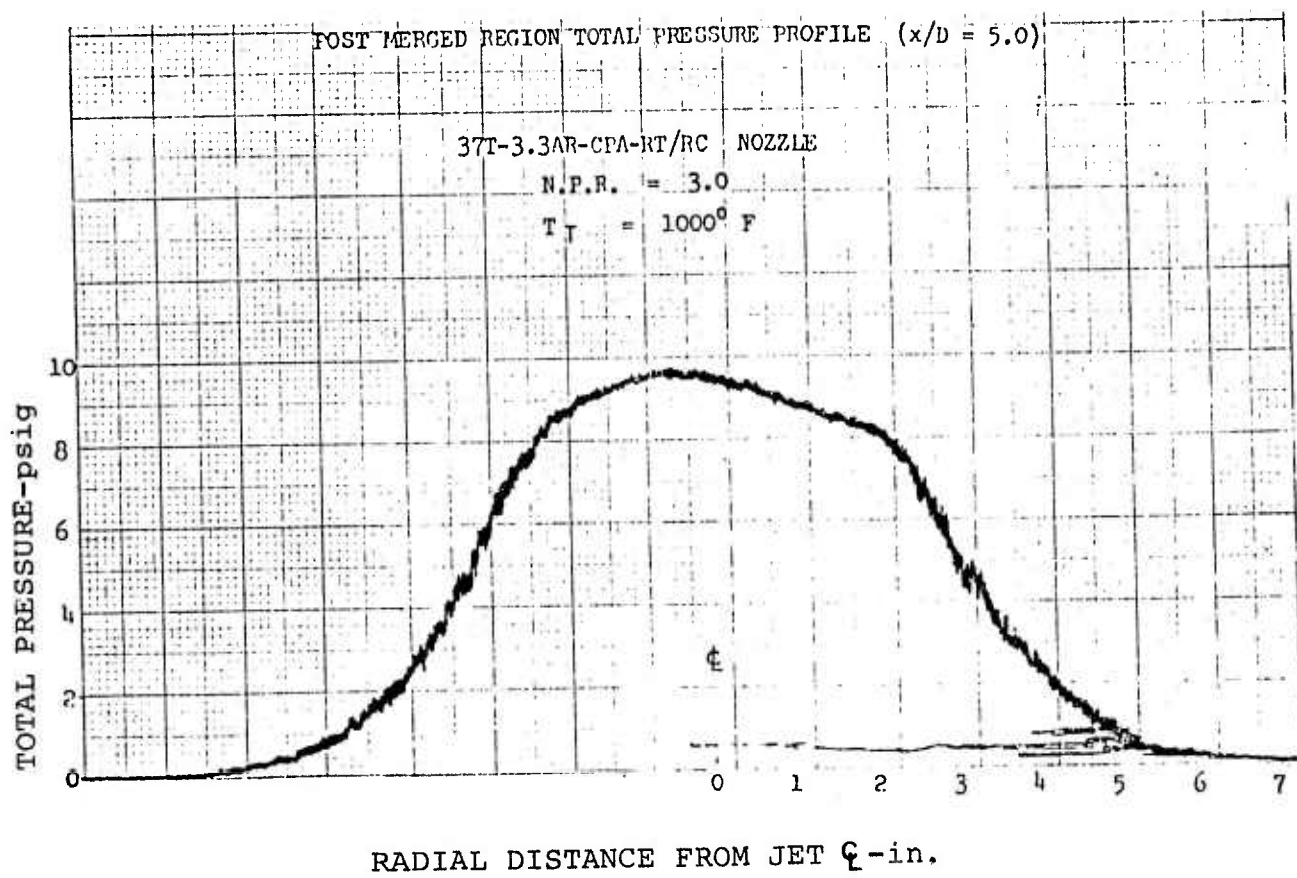


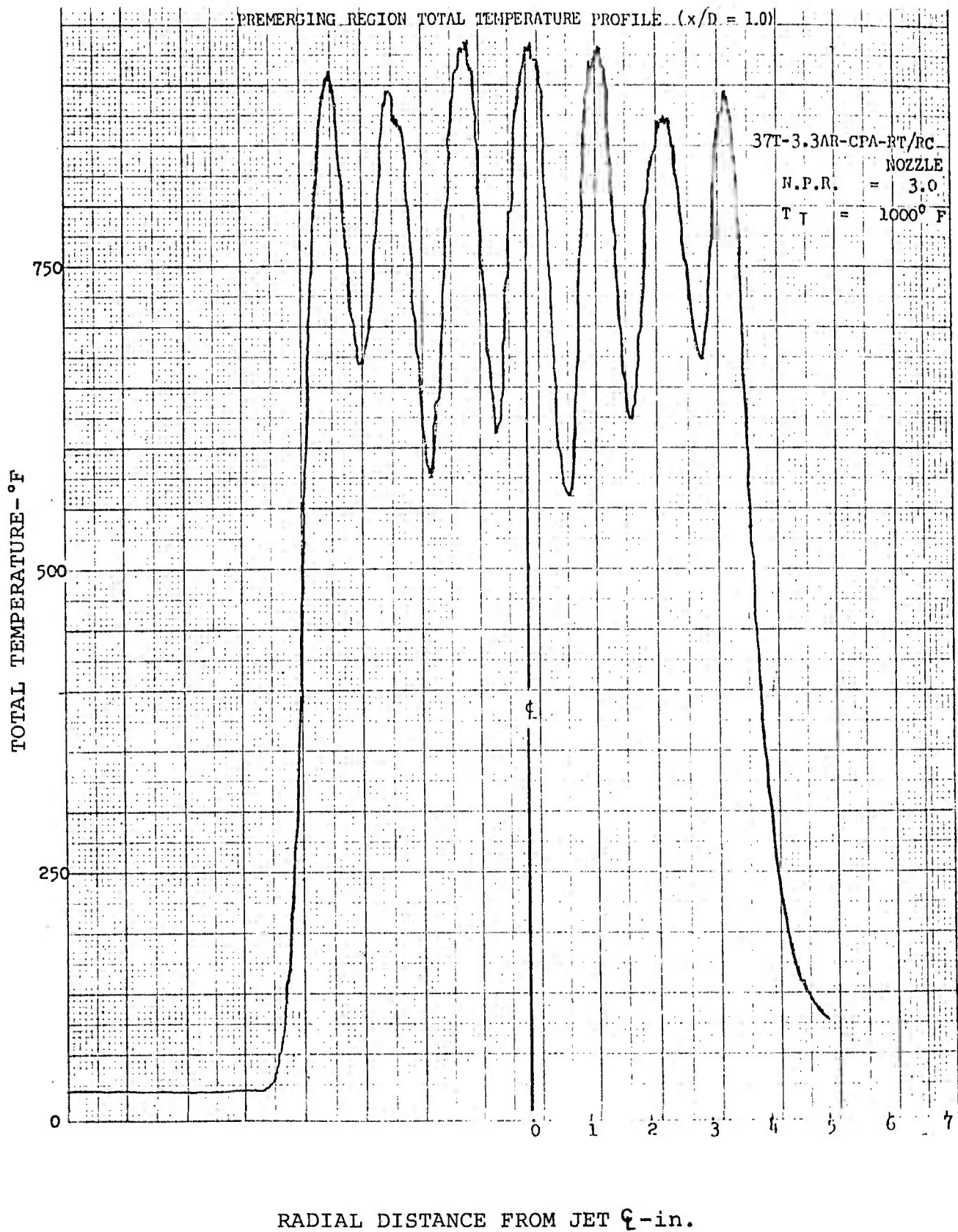
37T-3.3AR-CIA-RT/RC NOZZLE

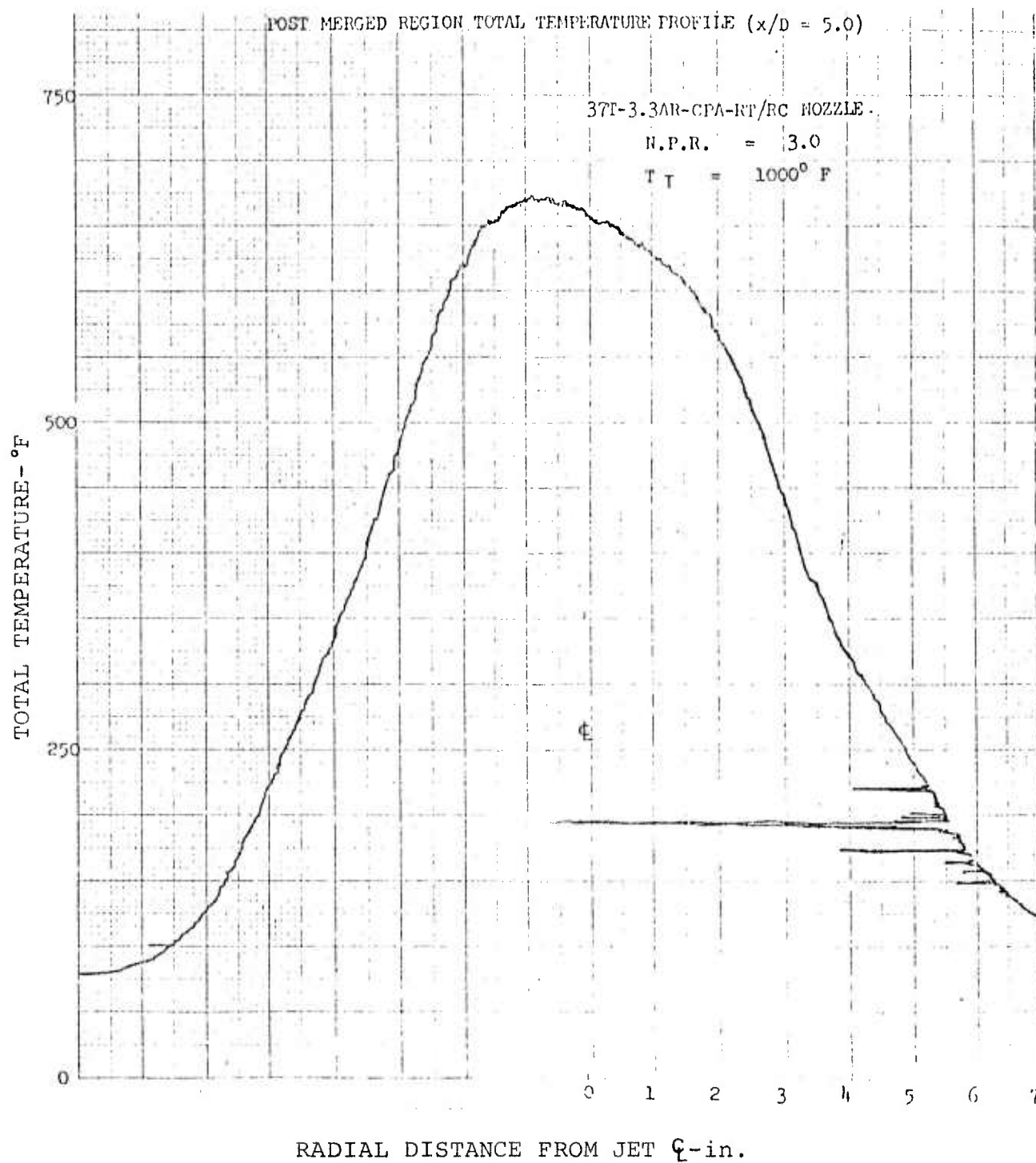


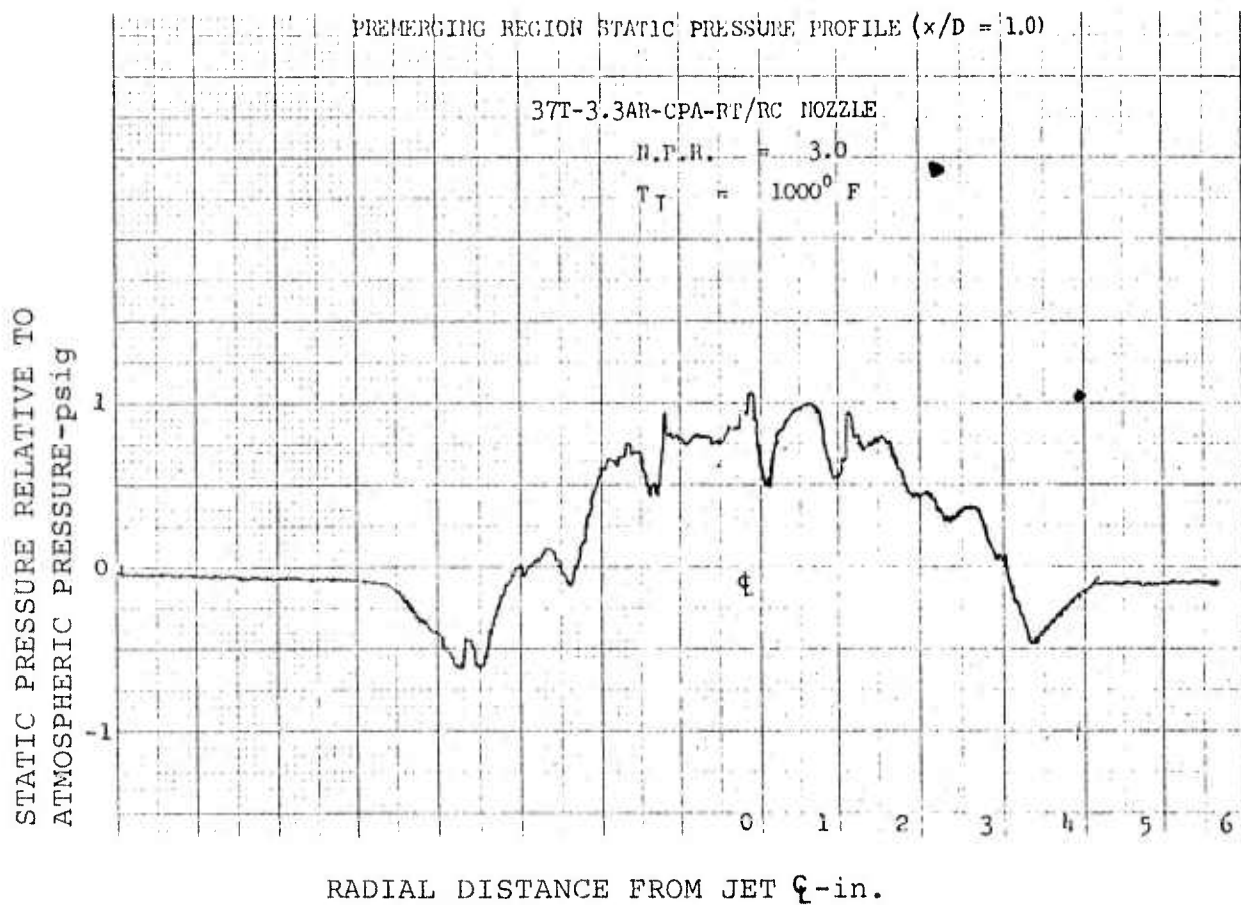
PREMERGING REGION TOTAL PRESSURE PROFILE ($x/D = 1.0$)

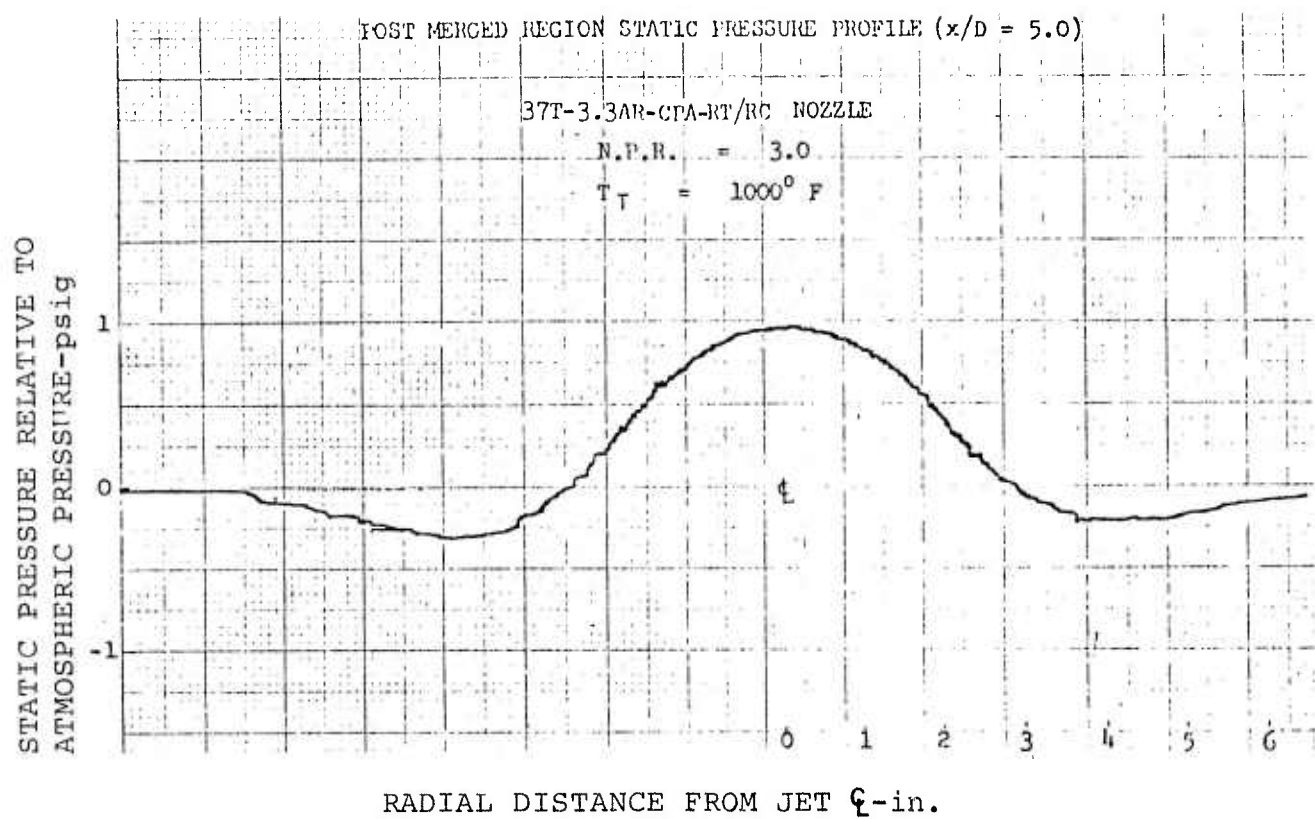


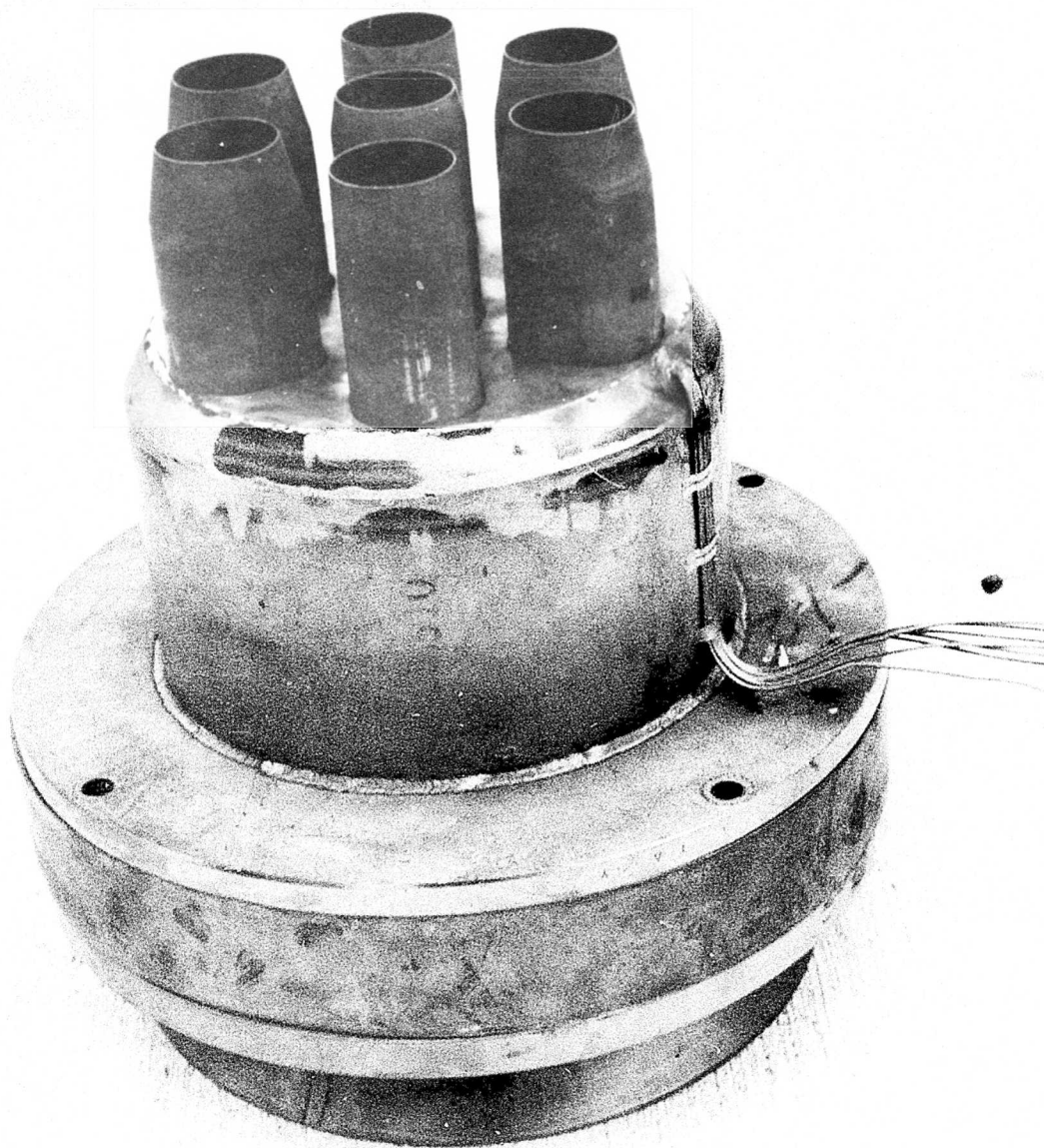




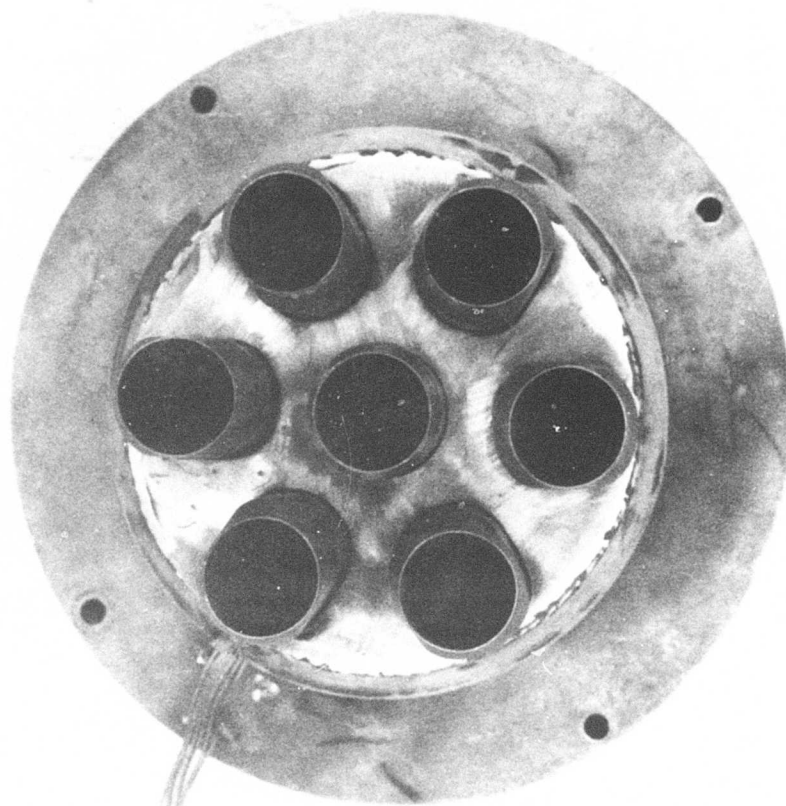








7T-3.3AR-CPA-ET/RC NOZZLE

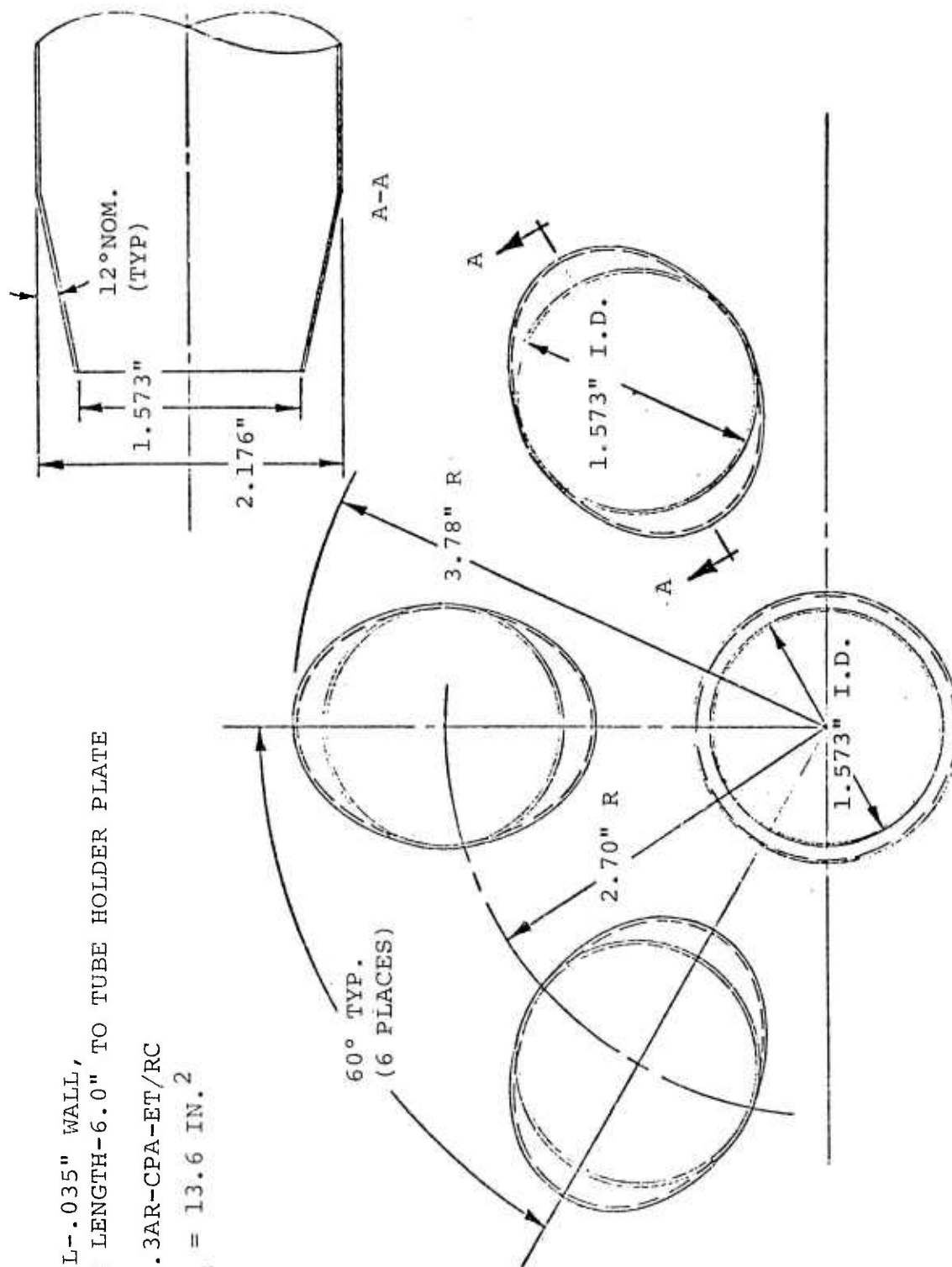


7T-3.3AR-CPA-ET/RC NOZZLE

MAT'L-.035" WALL,
TUBE LENGTH-6.0" TO TUBE HOLDER PLATE

7T-3.3AR-CPA-ET/RC

$A_8 = 13.6 \text{ IN.}^2$



7 TUBE - AREA RATIO 3.3 ELLIPTICAL TUBES

TEST CONDITIONS

NOZZLE: 7T-3.3AR-CPA-ET/RC

FACILITY: HNTF

DATE: 6-11-73

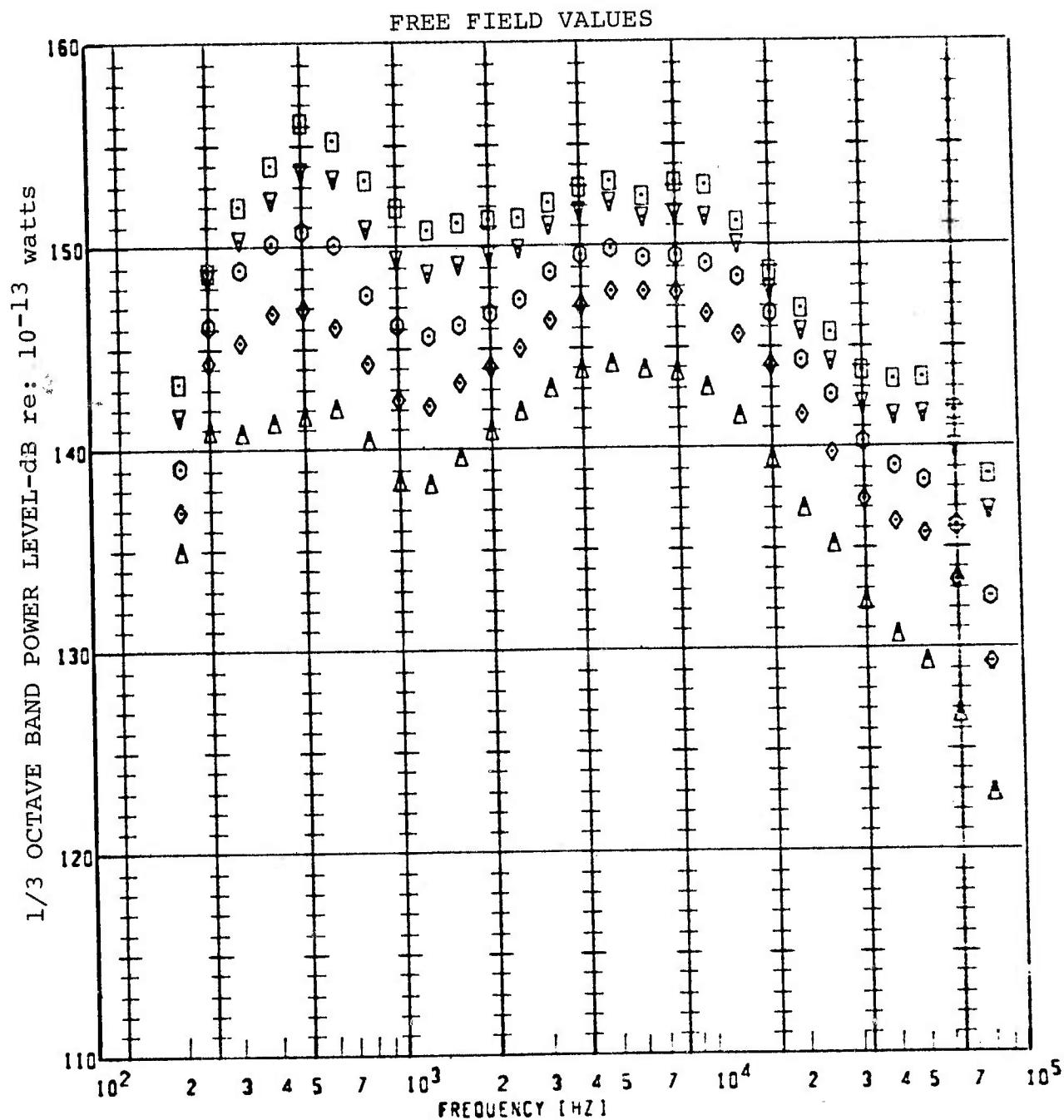
T_{AMB} = 73°F

R.H. = 36%

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
8	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.5	"	2437		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

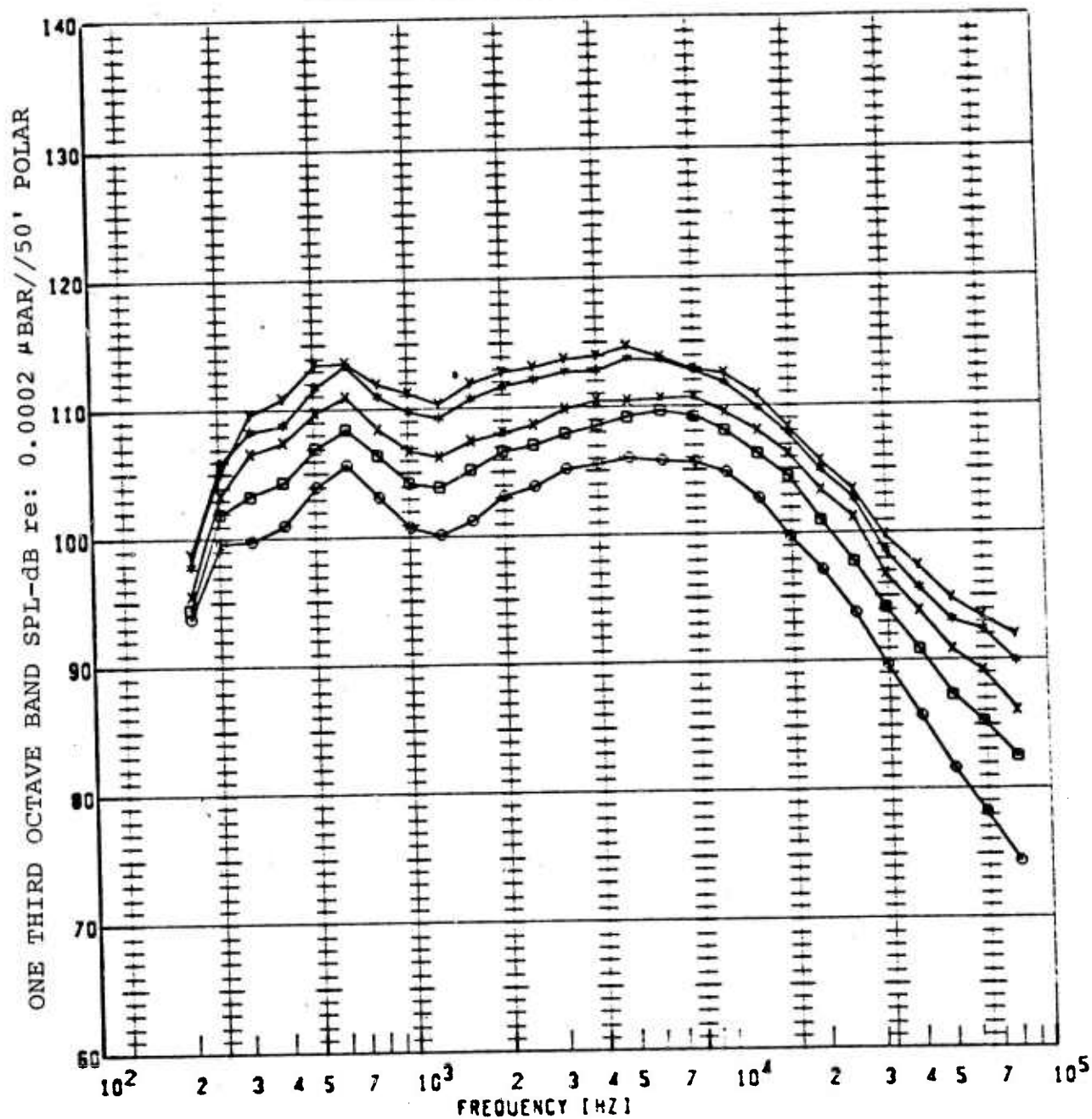


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	008	2.00	1150 °F
◇	008	2.50	1150
○	008	3.00	1150
▽	008	3.50	1150
□	008	4.00	1150

NOZZLE: 7T-3.3AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

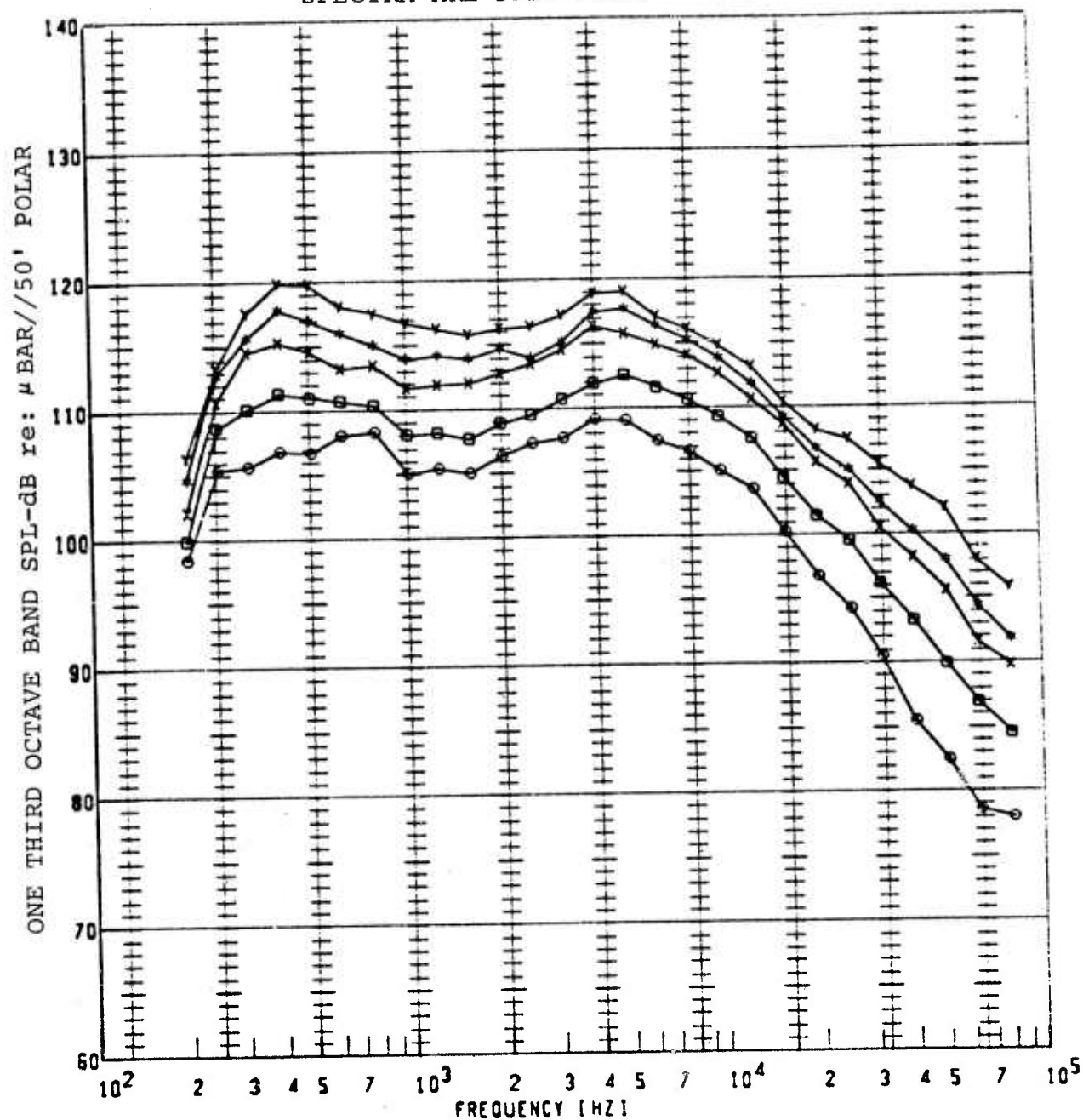


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	CASPL 1091
o	008G	1150°F	2.000	110°	50FP	116.5
□	008G	1150	2.500	↓	50FP	119.8
x	008G	1150	3.000		50FP	121.7
*	008G	1150	3.500		50FP	124.3
y	008G	1150	4.000		50FP	125.2

NOZZLE: 7T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

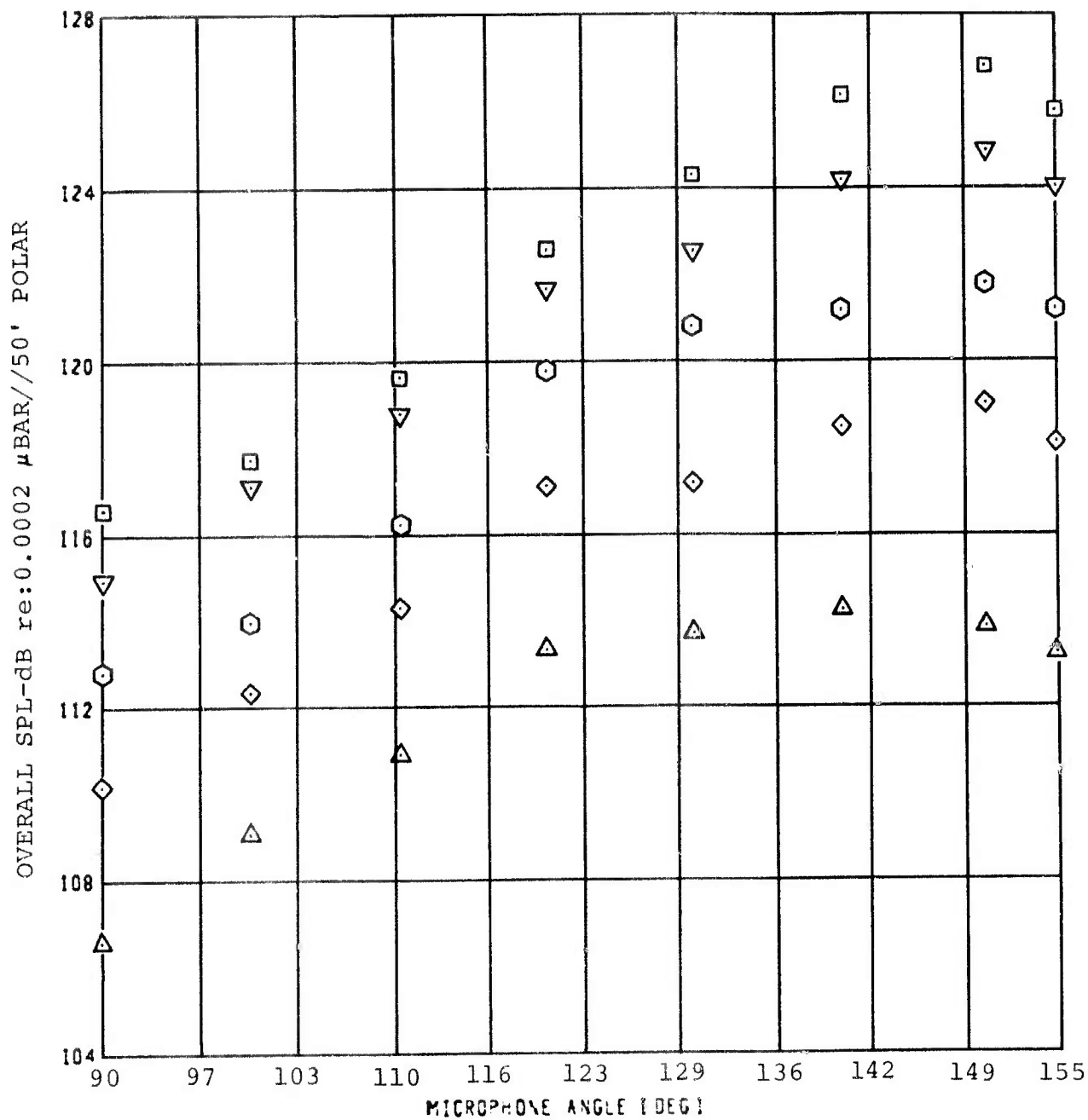


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
○	008G	1150°F	2.000	130°	50FP	119.5
□	008G	1150	2.500		50FP	122.9
x	008G	1150	3.000		50FP	126.5
*	008G	1150	3.500		50FP	128.2
Δ	008G	1150	4.000		50FP	129.9

NOZZLE: 7T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

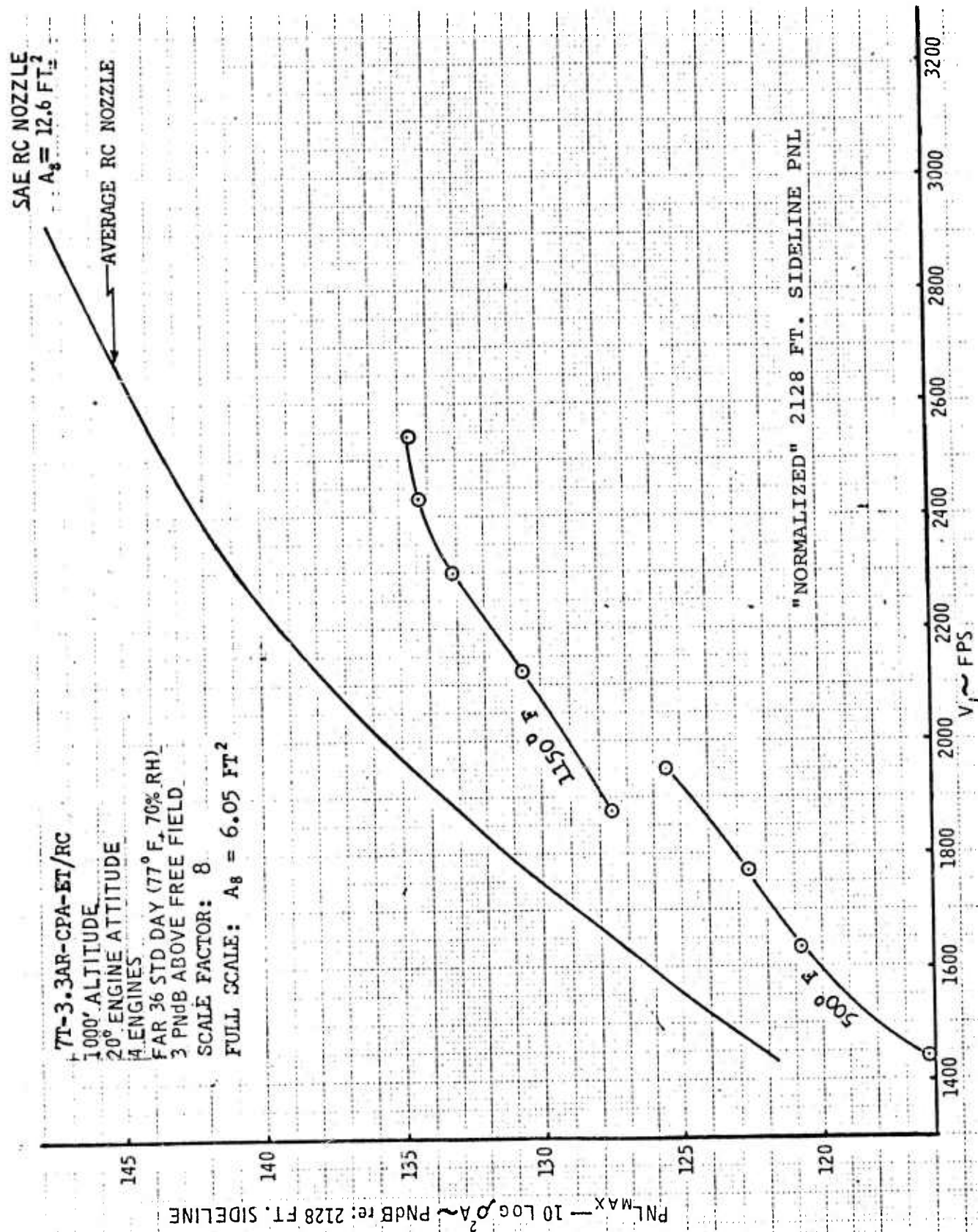
FREE FIELD VALUES



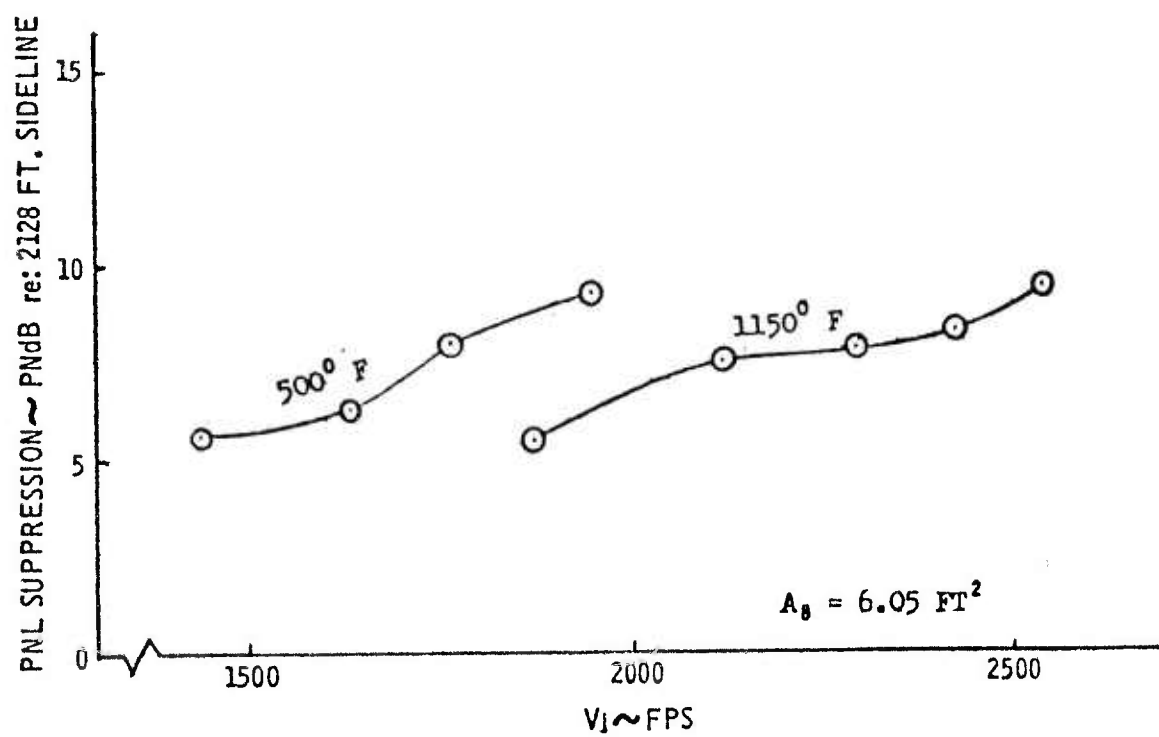
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	008	2.00	1150°F
◊	008	2.50	1150
○	008	3.00	1150
▽	008	3.50	1150
◻	008	4.00	1150

NOZZLE: 7T-3.3AR-CPA-ET/RC

OASPL BEAM PATTERNS

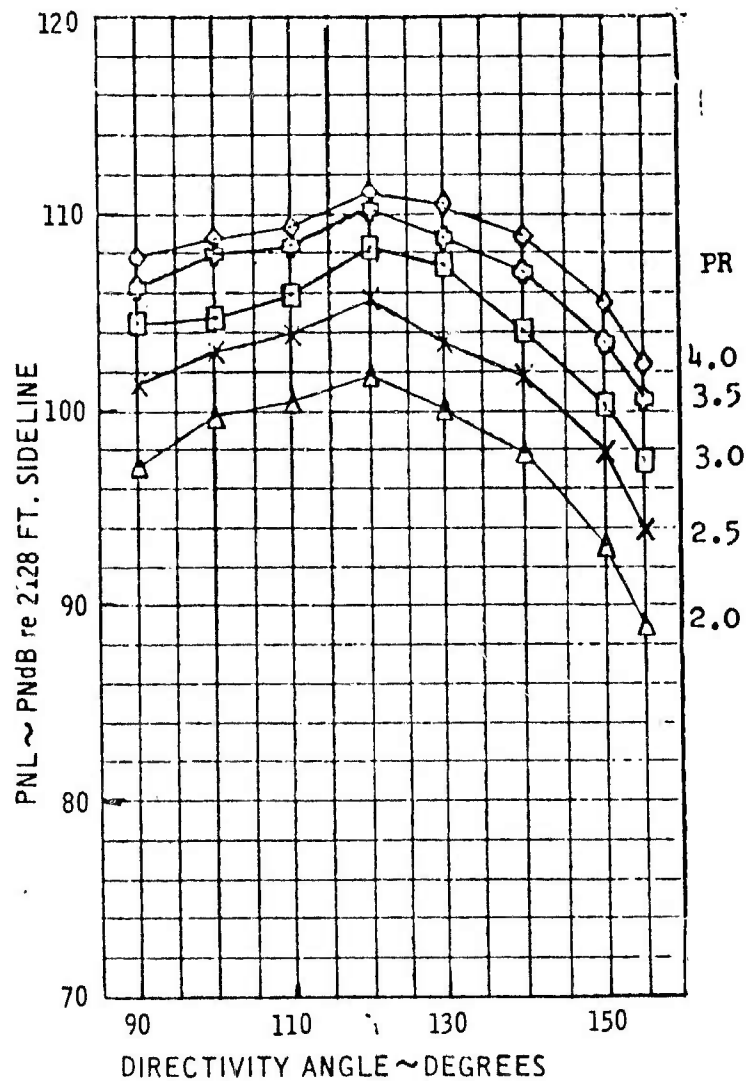


7T-3.3AR-CPA-ET/RC



PEAK PNL SUPPRESSION VALUES

NOZZLE: 7T-3.3AR-CPA-RT/RC



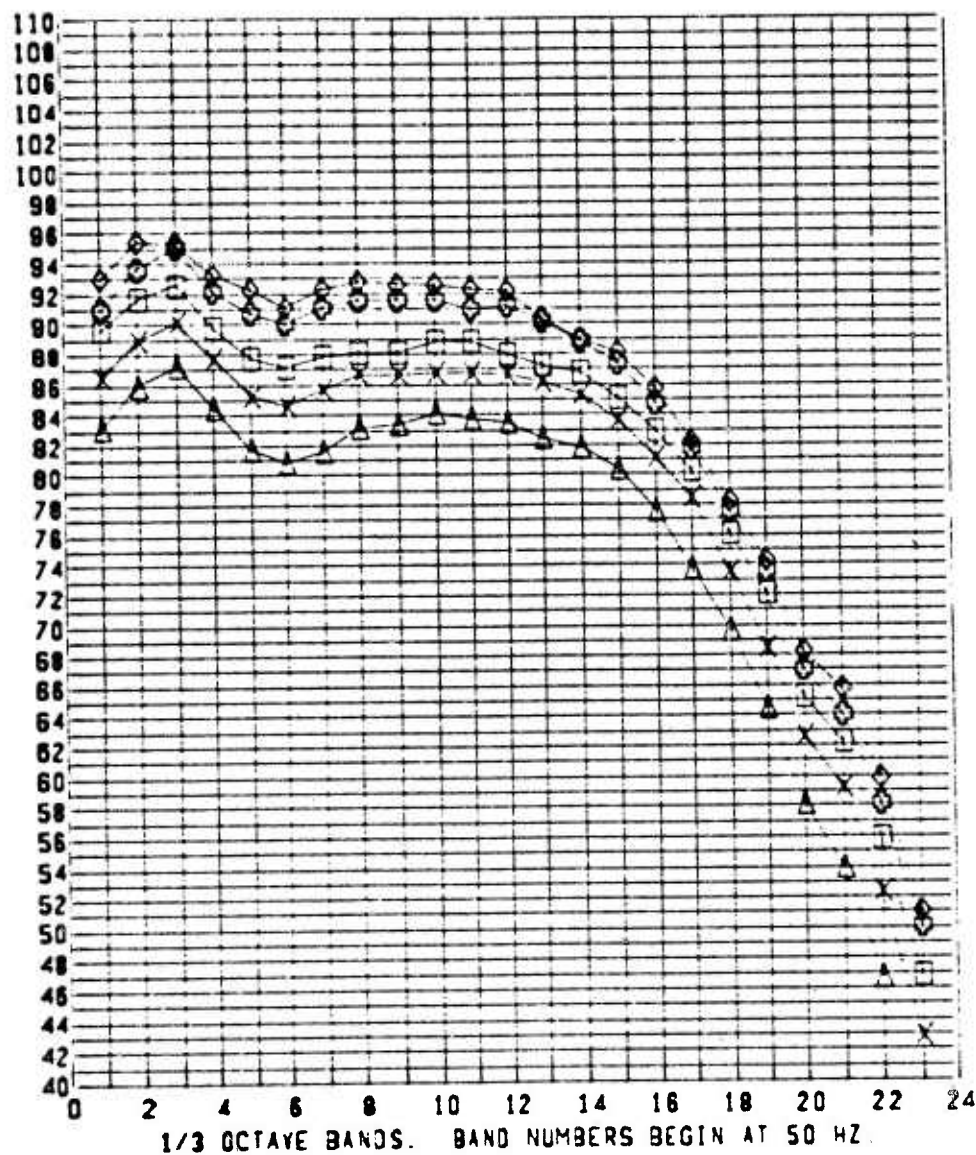
RUN 008
 $T_T = 1150^{\circ} F$ $A_8 = 6.05 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



$T_T = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 008

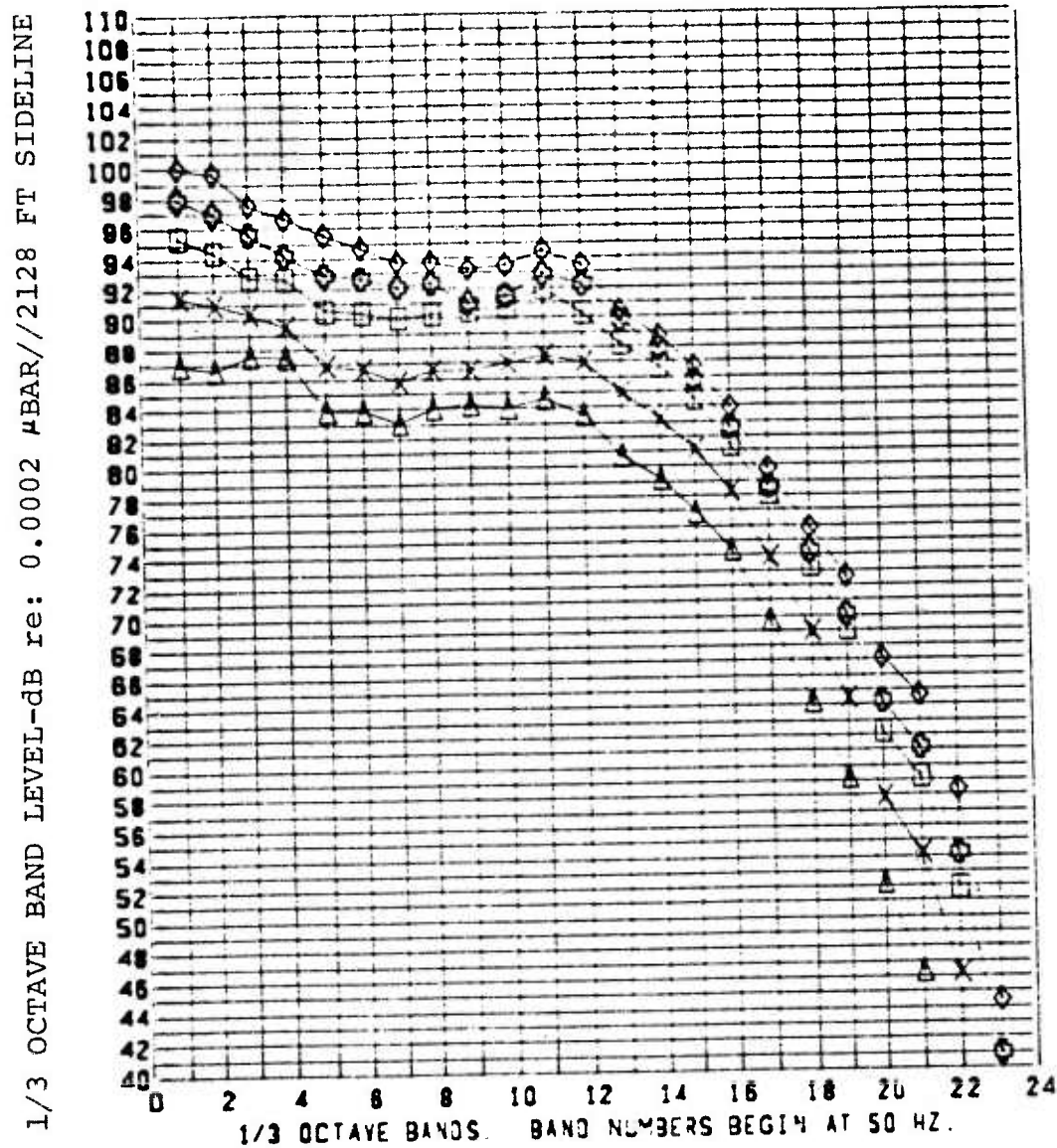
PR = Δ 2.0, X 2.5, \square 3.0, + 3.5, \diamond 4.0

NOZZLE: 7T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



$T_t = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 008

PR = \triangle 2.0, \times 2.5, \square 3.0, \oplus 3.5, \diamond 4.0

NOZZLE: 7T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 7T-3.3AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 18, 1973

P_{AMB} = 29.43 in Hg **T_{AMB}** = 47°F **R.H.** = 66%

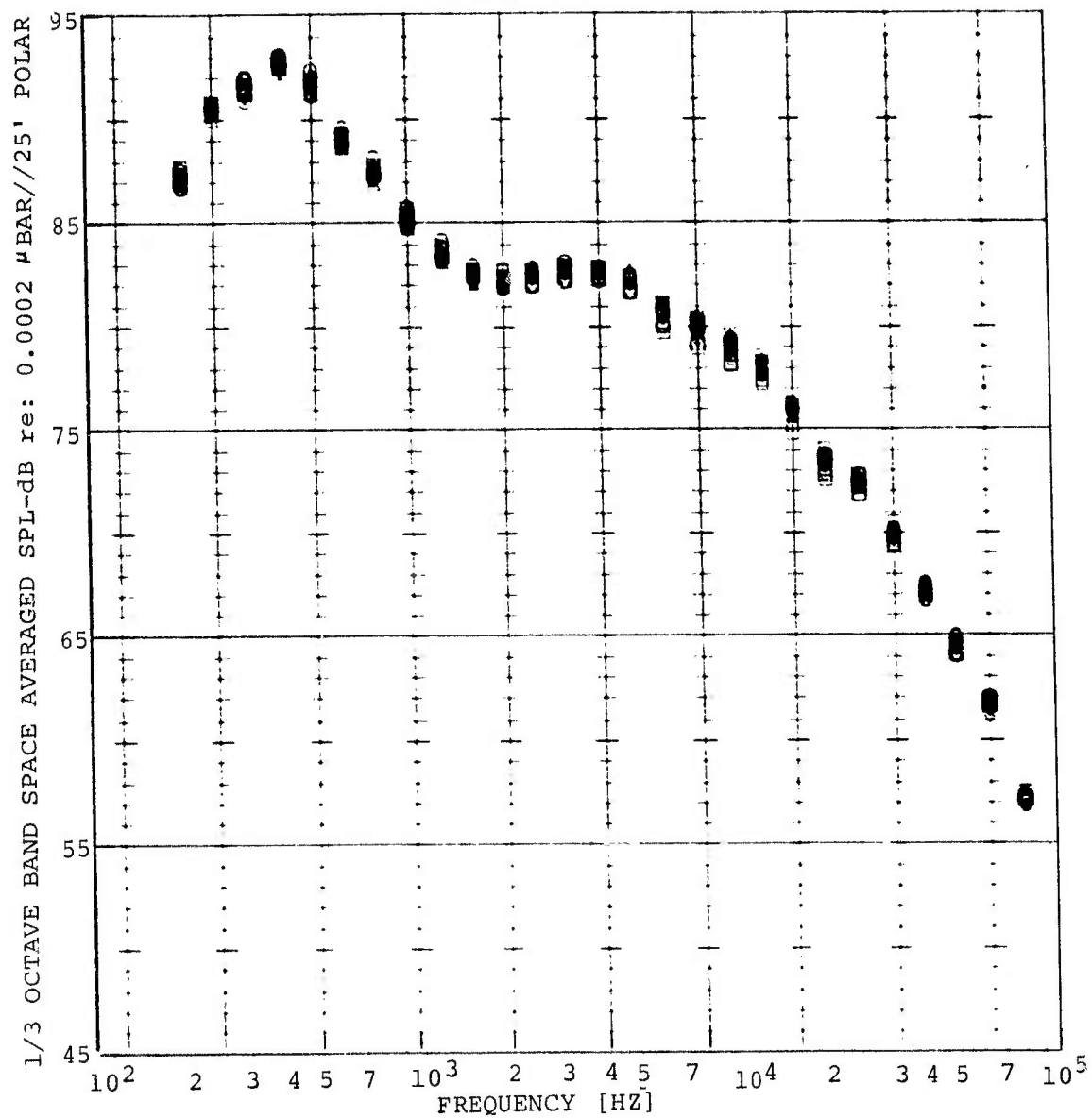
NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

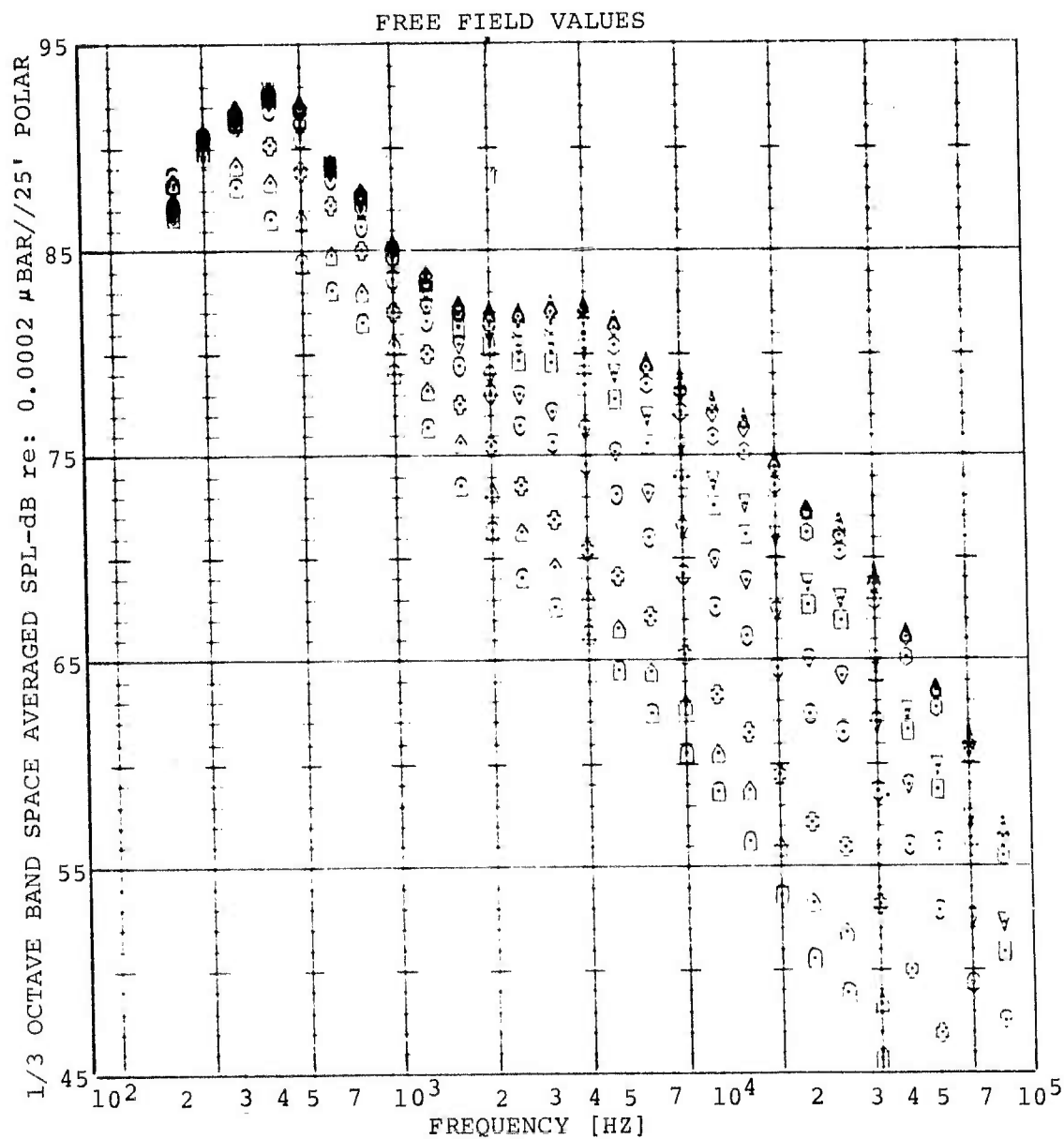
<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
75	0.0 x/D	9.0 in.		
76	0.25	9.0		
77	0.50	9.0		
78	0.75	9.0		
79	1.00	10.0		
80	1.25	10.0		
81	1.50	10.5		
82	1.75	10.5		
83	2.00	11.0		
84	2.25	11.0		
85	2.50	11.5		
86	2.75	11.5		
87	3.0	12.0		
88	3.5	13.0		
89	4.0	14.0		
90	5.0	16.0		
91	6.0	18.0		
92	8.0	19.0		
93	10.0	21.0		
94	12.0	23.0		
95	14.0	25.0		
96	16.0	27.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

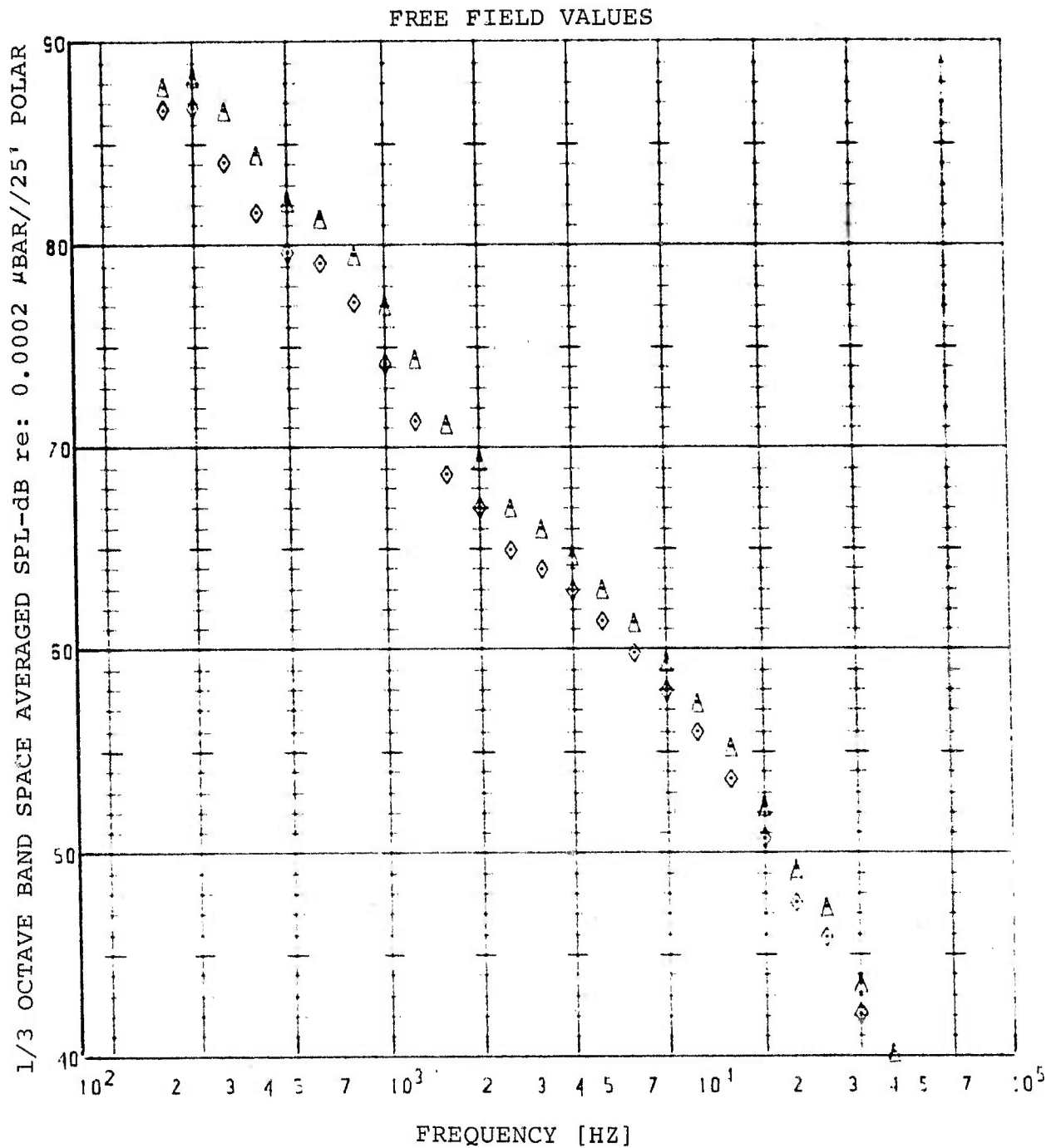
FREE FIELD VALUES



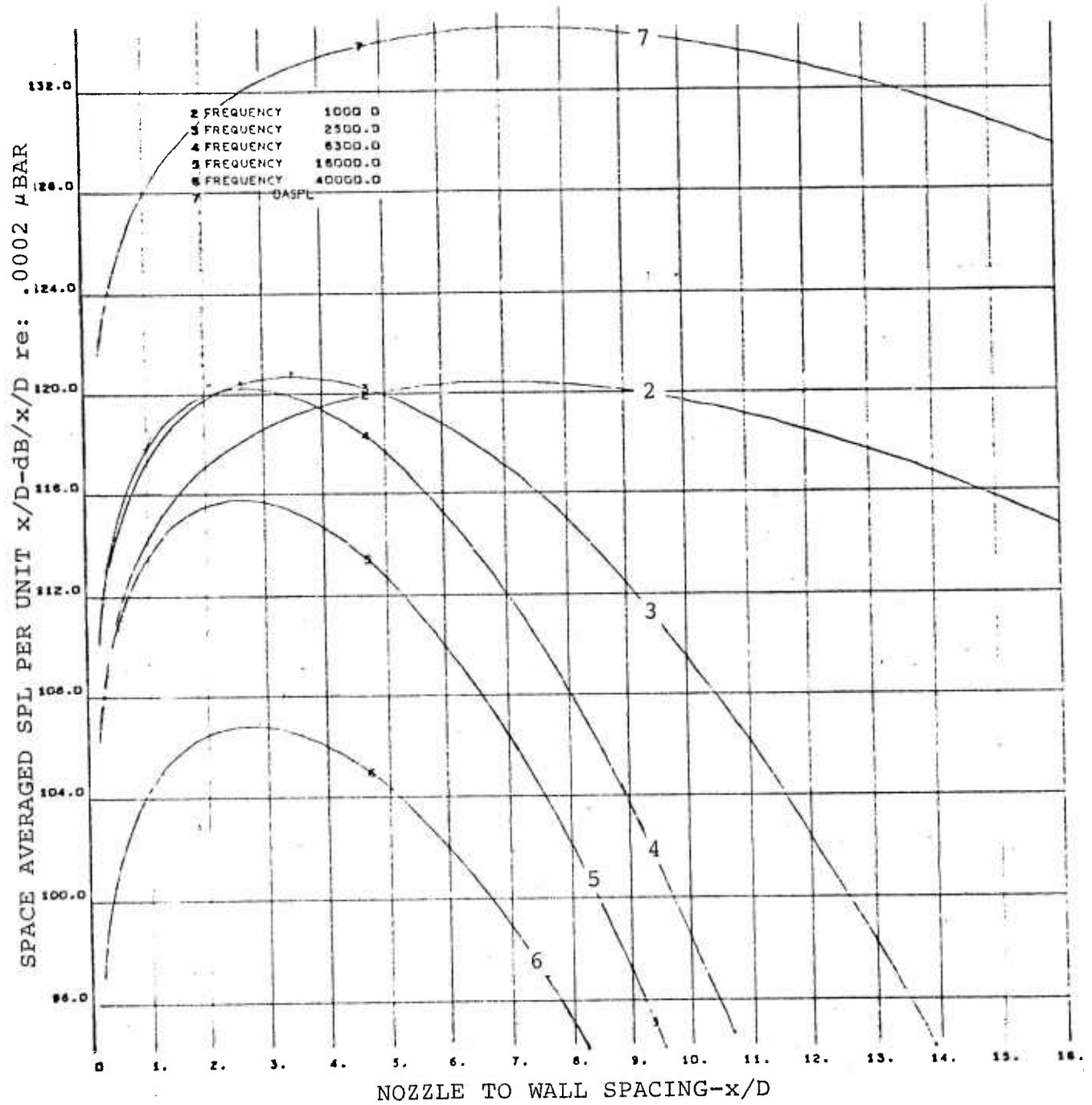
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	75	1150°F	3.000	0.0
◊	76	1150	3.000	.25
⊙	77	1150	3.000	.50
▽	78	1150	3.000	.75
⊠	79	1150	3.000	1.0
▽	80	1150	3.000	1.25
⊙	81	1150	3.000	1.5
⊕	82	1150	3.000	1.75
△	83	1150	3.000	2.0
⊙	84	1150	3.000	2.25

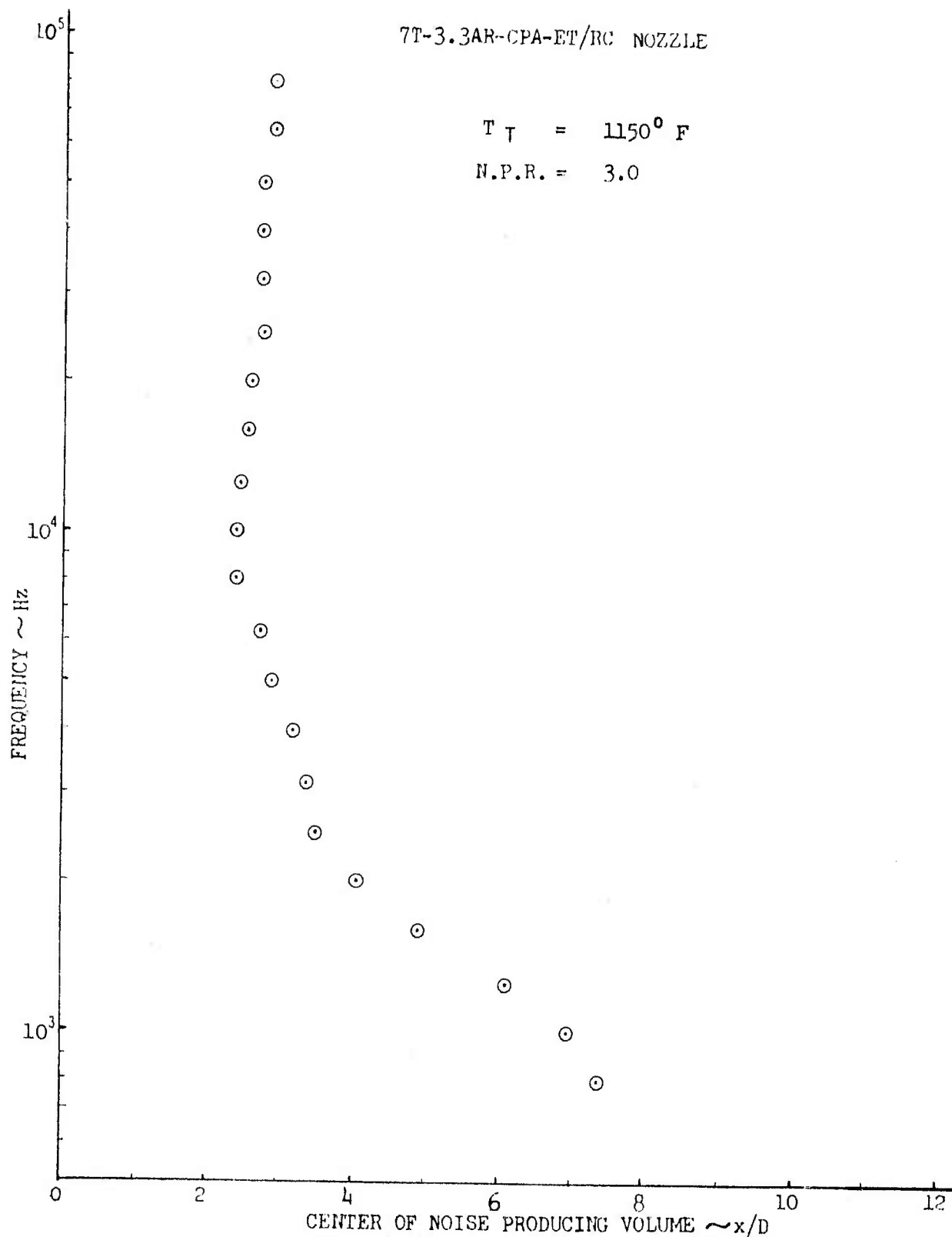


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	85	1150°F	3.000	2.5
◇	86	1150	3.000	2.75
⊙	87	1150	3.000	3.0
▽	88	1150	3.000	3.50
□	89	1150	3.000	4.00
◊	90	1150	3.000	5.00
⊗	91	1150	3.000	6.00
⊕	92	1150	3.000	8.00
⊖	93	1150	3.000	10.00
⊗	94	1150	3.000	12.00



<u>PLOT SYMBOL</u>	<u>RUN NUMBER</u>	<u>JET TEMP</u>	<u>PRESSURE RATIO</u>	<u>AXIAL LOCATION, x/D</u>
Δ	95	1150°F	3.0	14.00
◊	96	1150	3.0	16.00



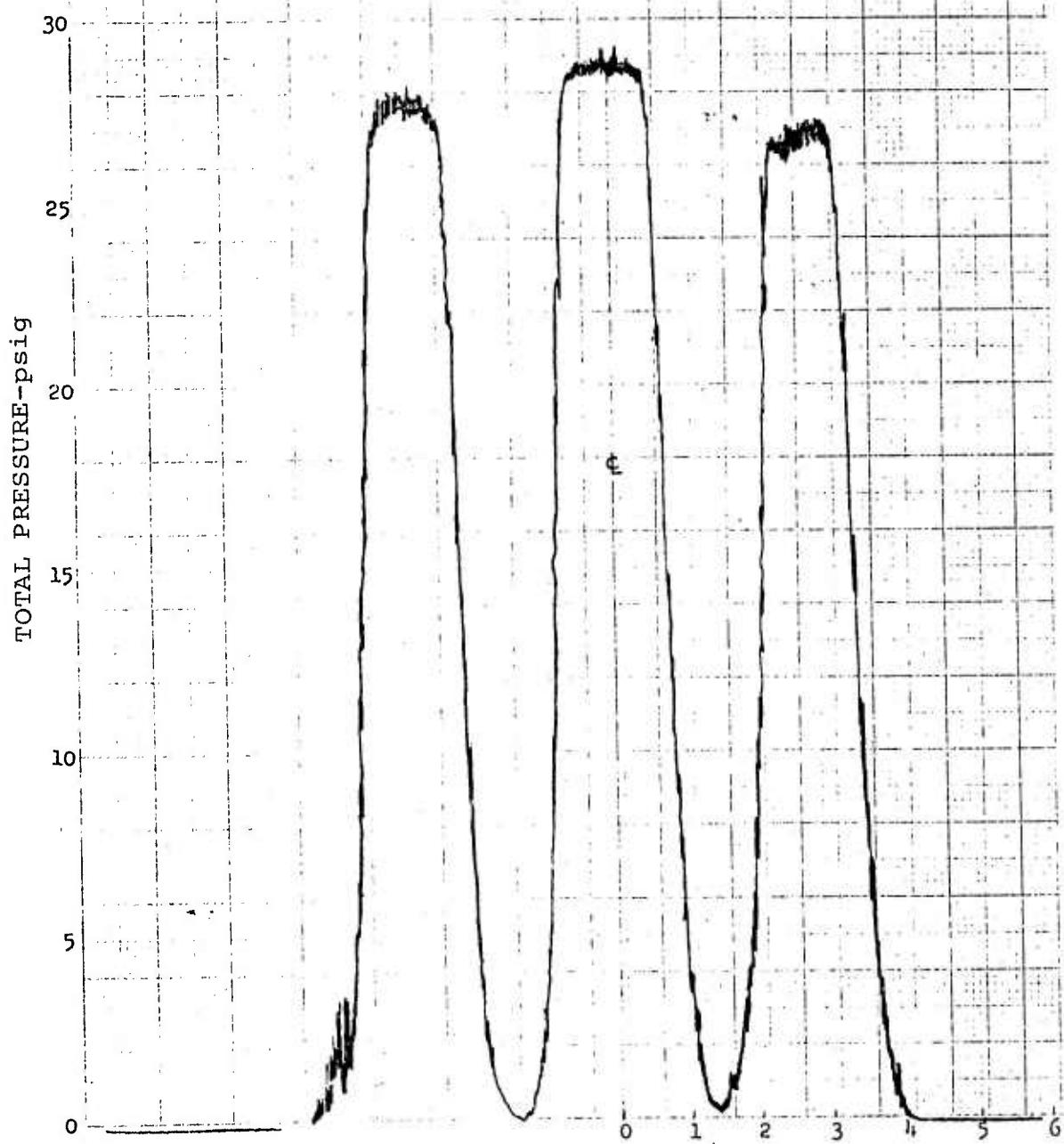


PREMERGING REGION TOTAL PRESSURE PROFILE ($x/D = 1.0$)

7T-3.3AR-CPA-ET/RC NOZZLE

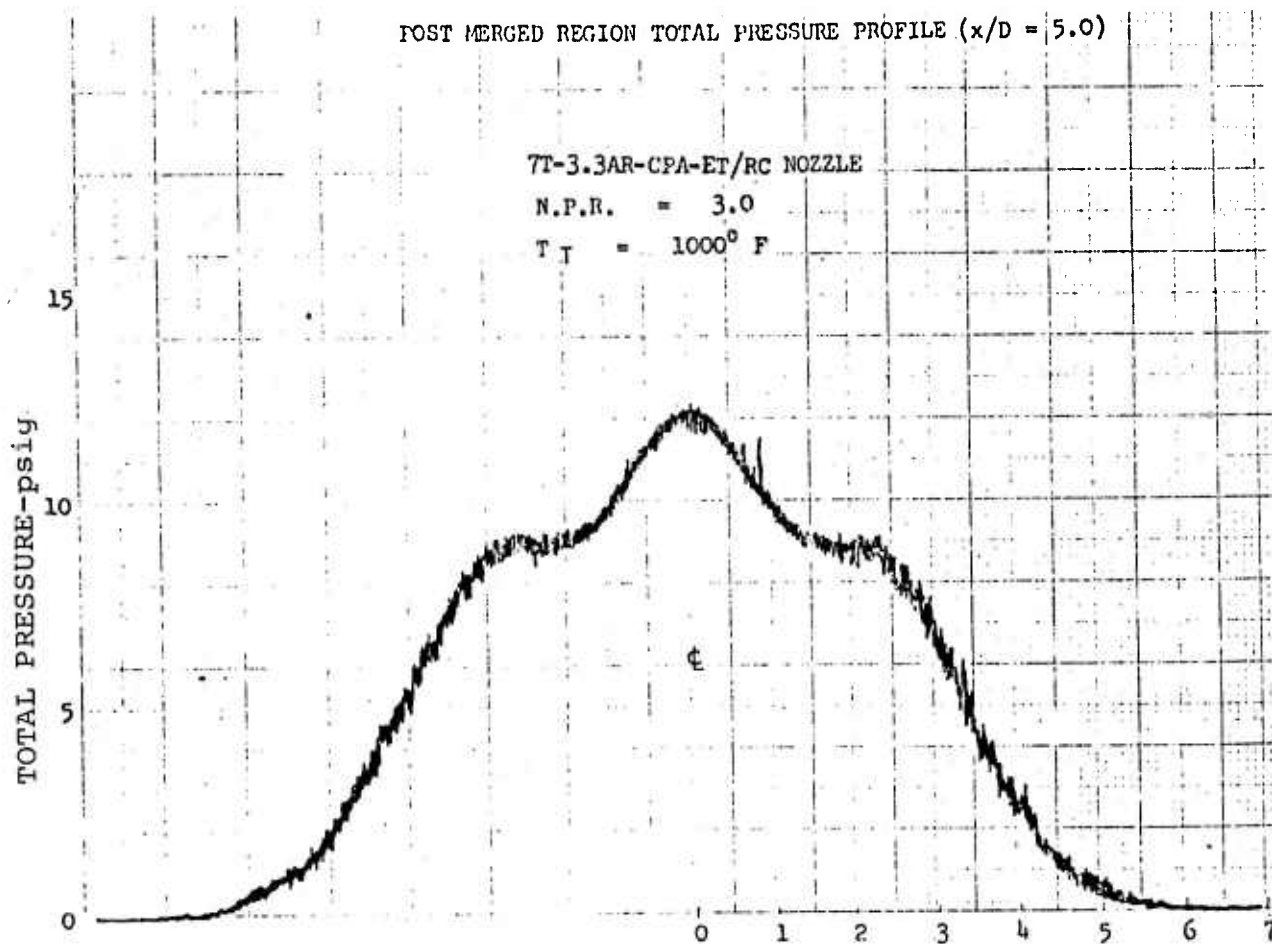
N.P.R. = 3.0

$T_T = 1000^\circ F$

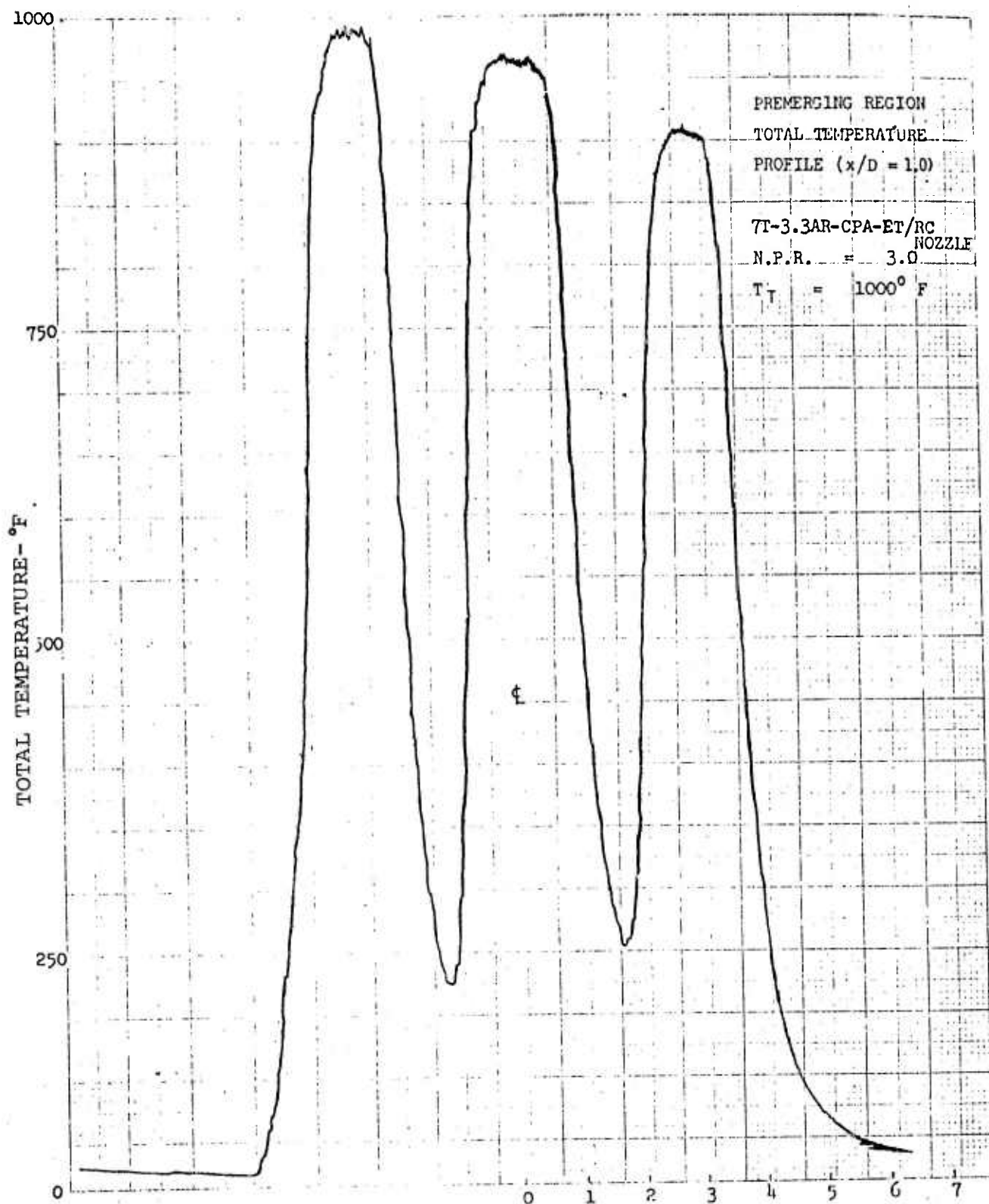


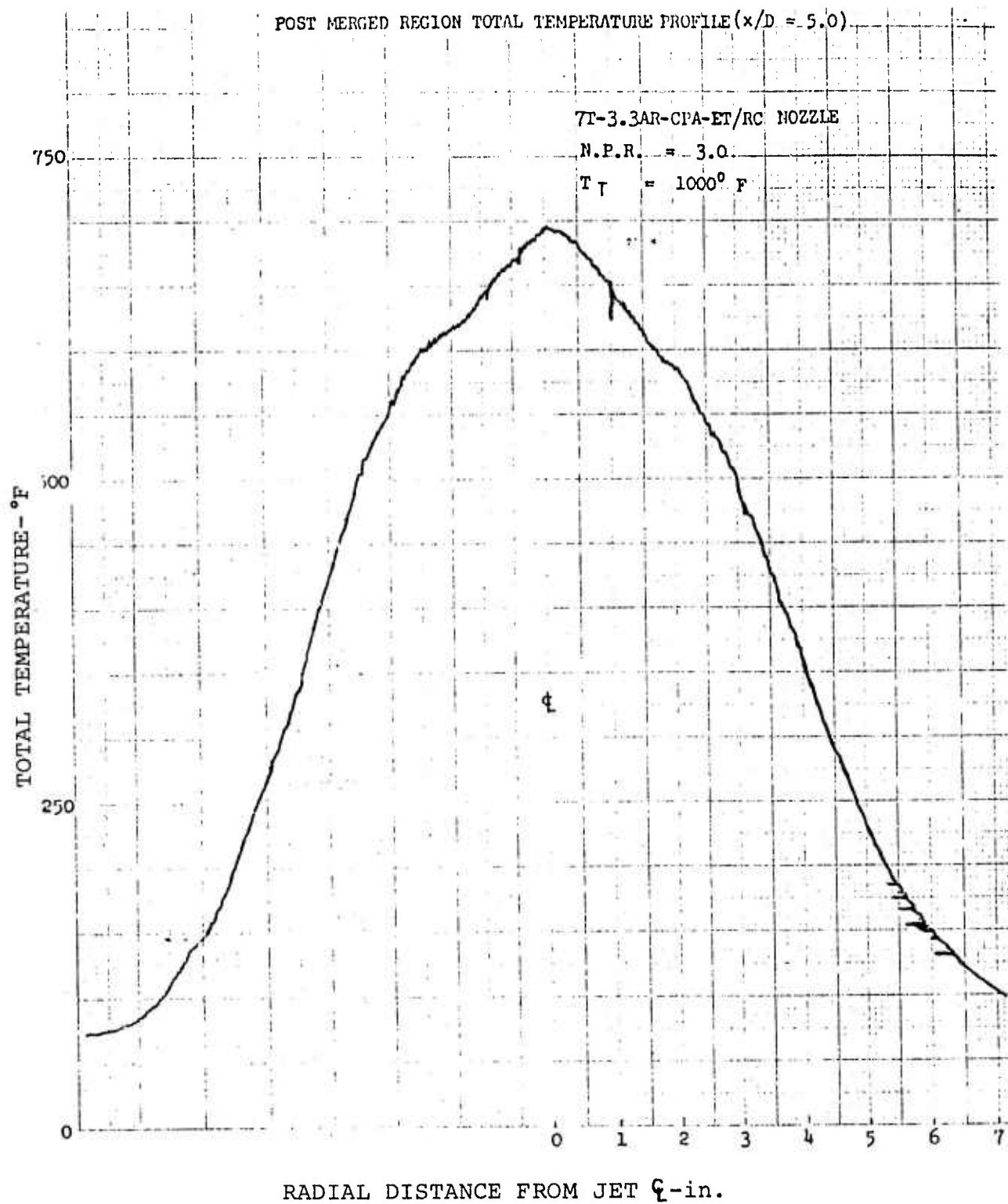
RADIAL DISTANCE FROM JET ζ -in.

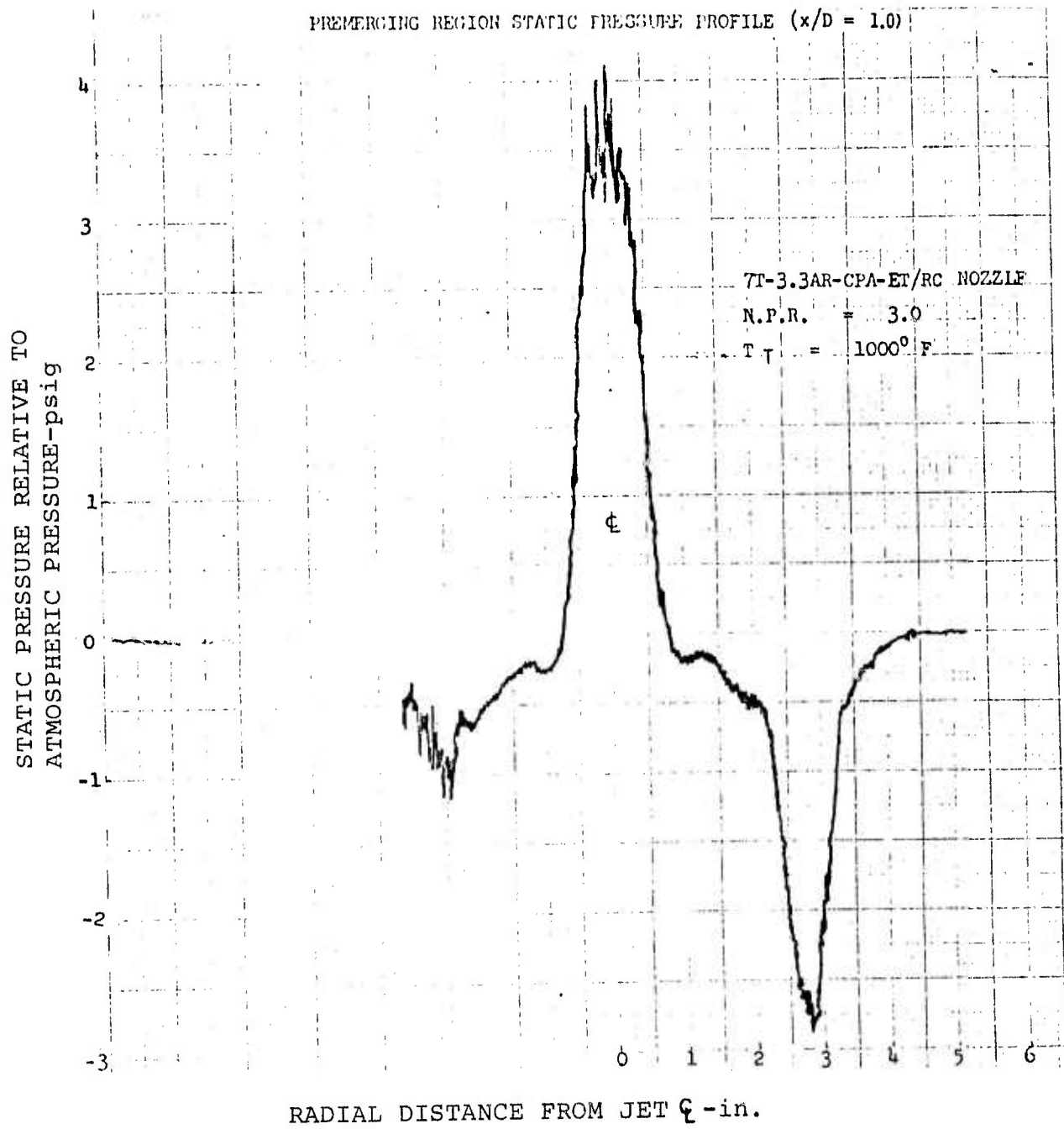
POST MERGED REGION TOTAL PRESSURE PROFILE ($x/D = 5.0$)

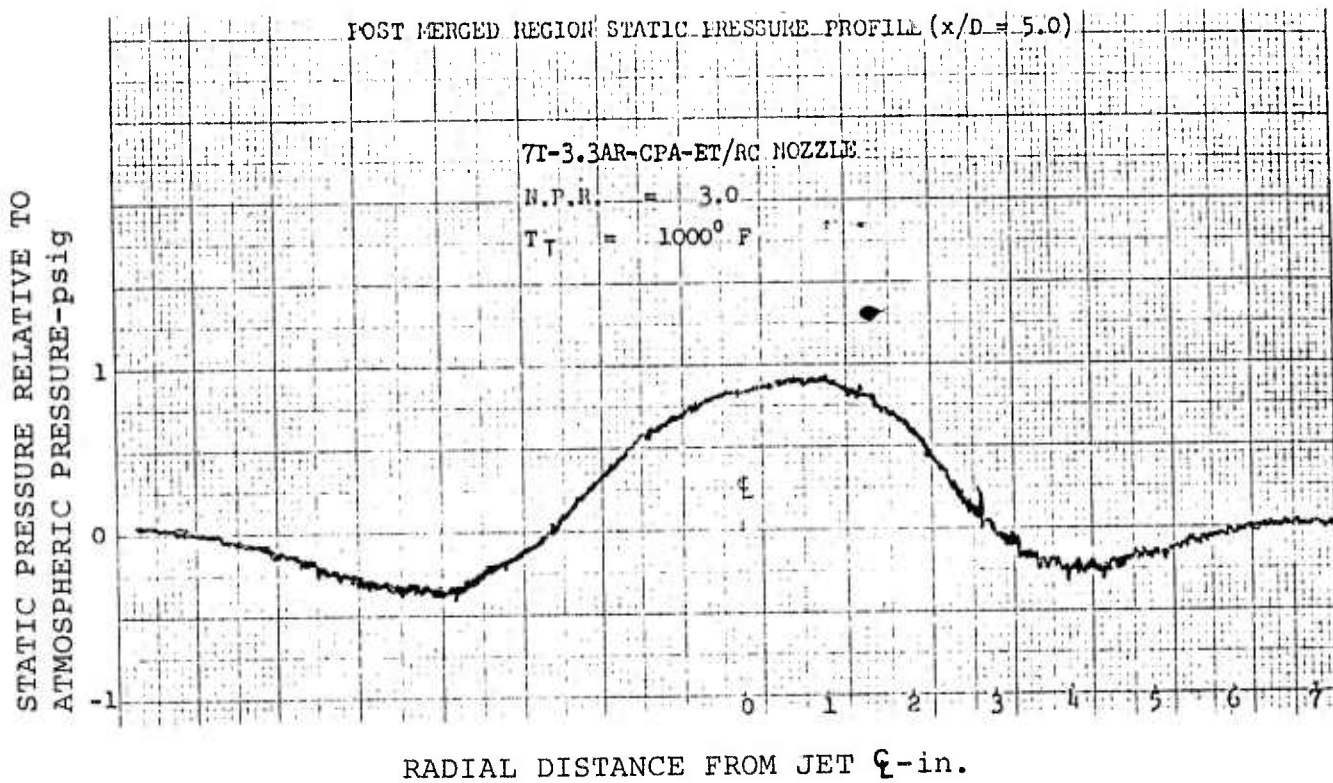


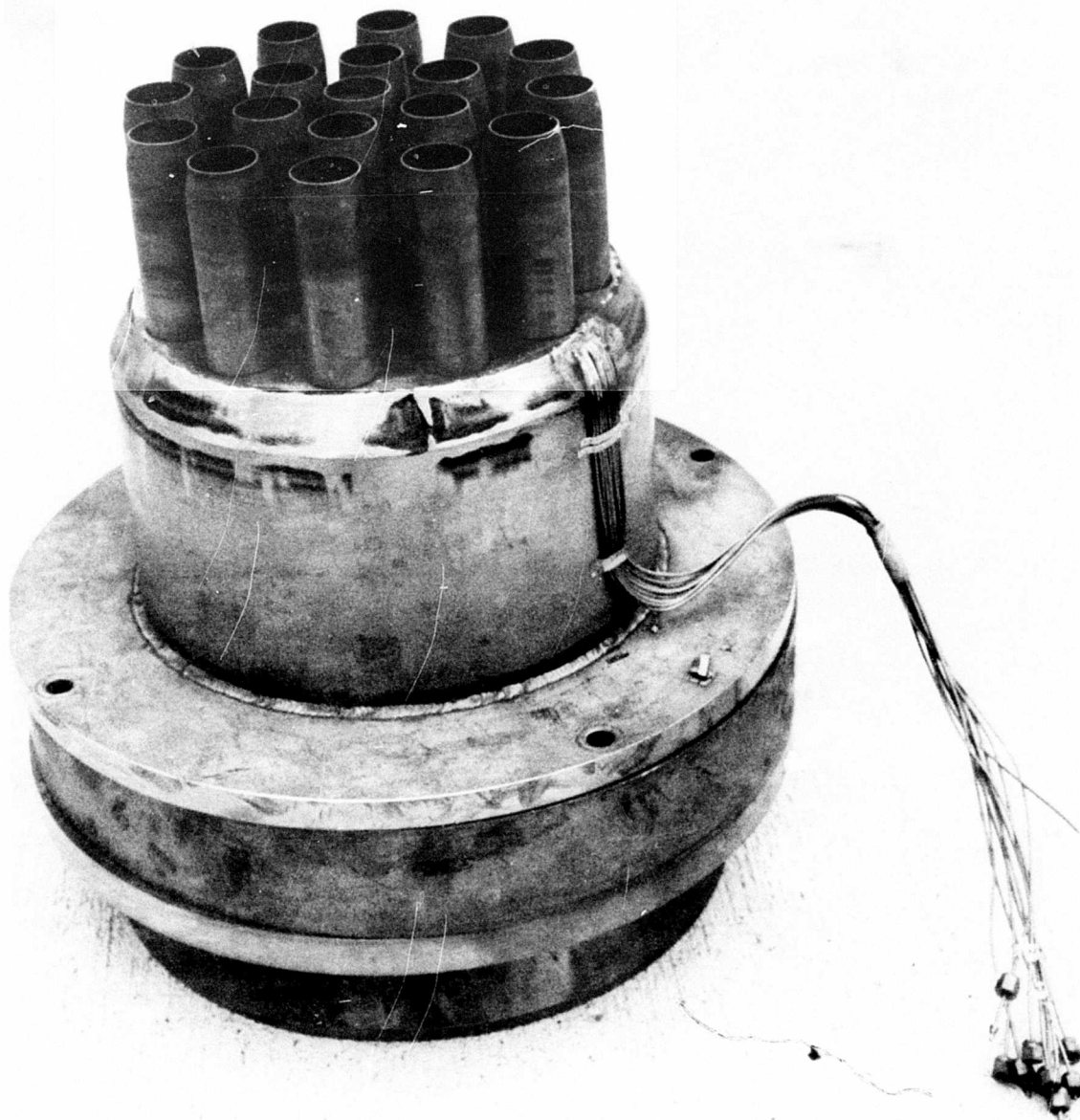
RADIAL DISTANCE FROM JET ξ -in.



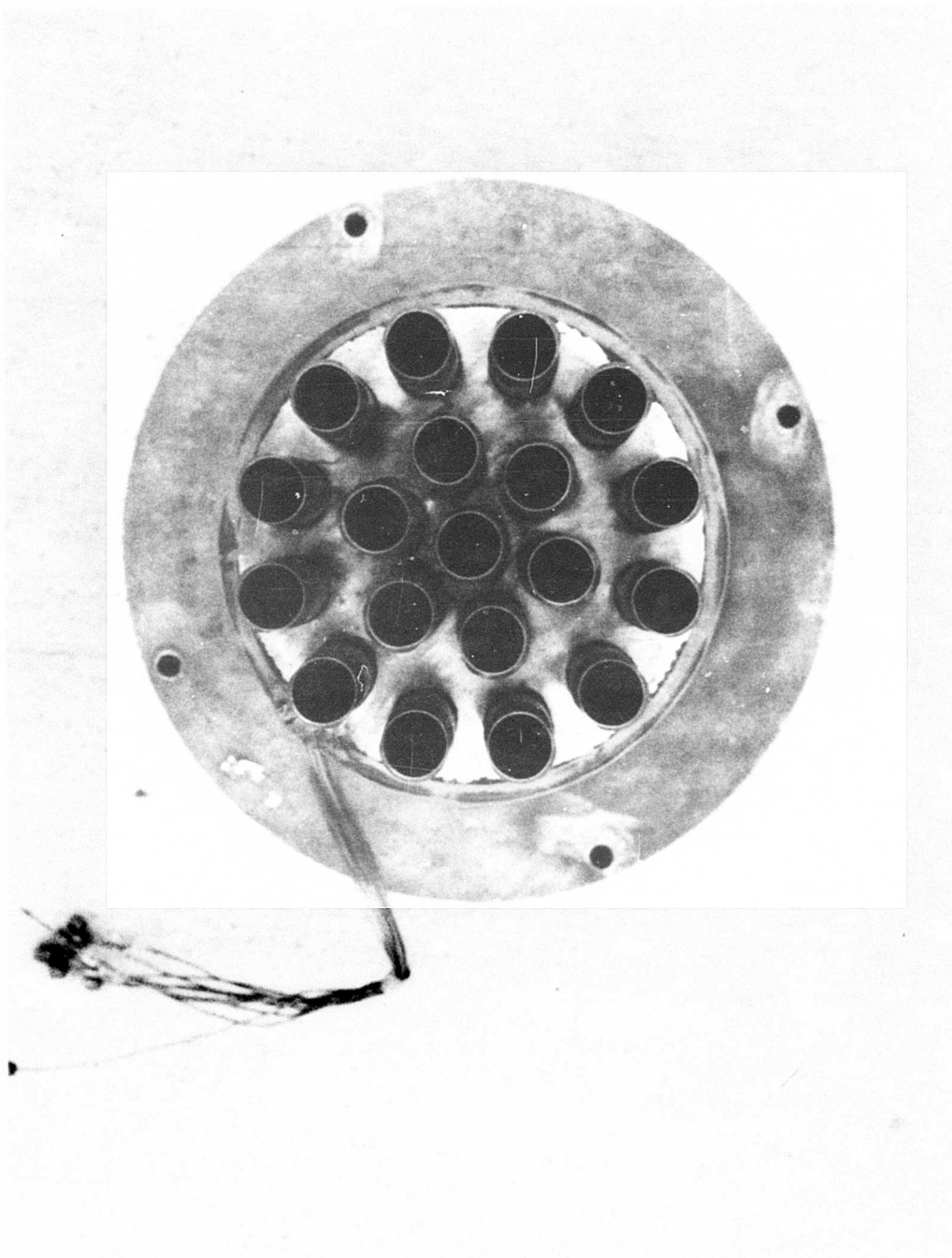








19T-3.3AR-CPA-ET/RC NOZZLE



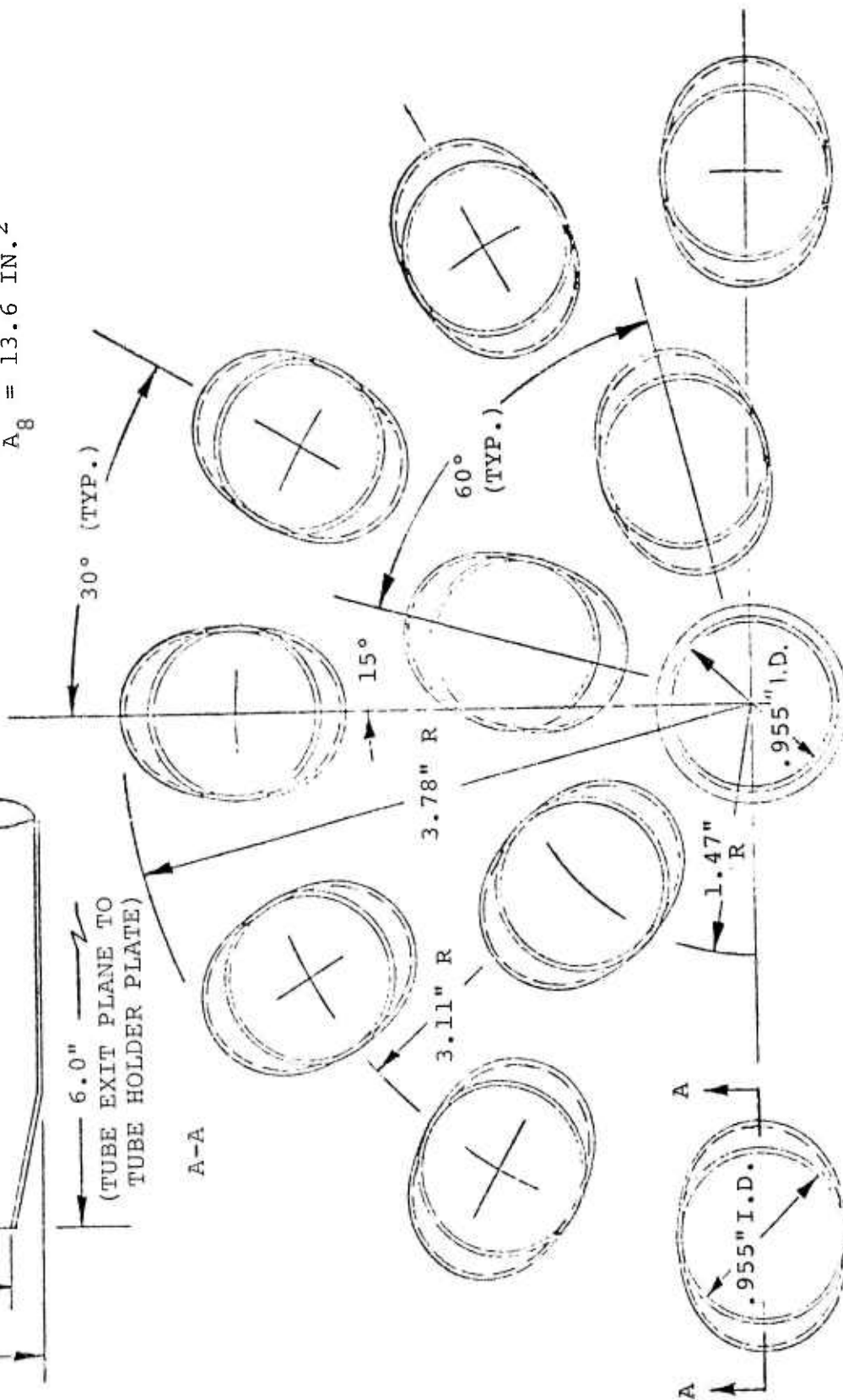
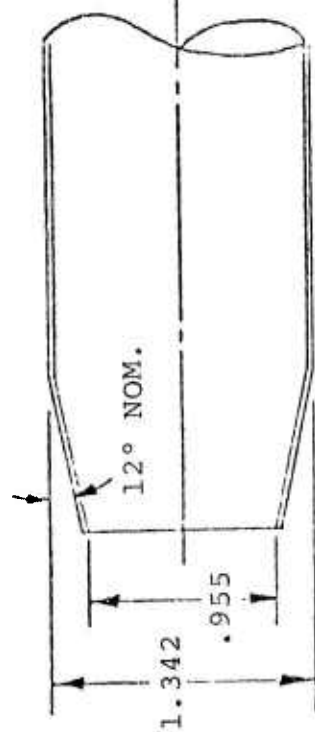
19T-3.3AR-CPA-ET/RC NOZZLE

MAT'L-.035" WALL

NOTE: CENTER TUBE IS A 1.125" DIA. TUBE
WITH A 12° NOM. CONVERGENCE TO .955" I.D.
EXIT

19T-3.3AR-CPA-ET/RC

$A_8 = 13.6 \text{ IN.}^2$



19 TUBE - AREA RATIO 3.3 ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 19T-3.3AR-CPA-ET/RC

FACILITY: HNTF

DATE: 6-11-73

T_{AMB} = 77°F

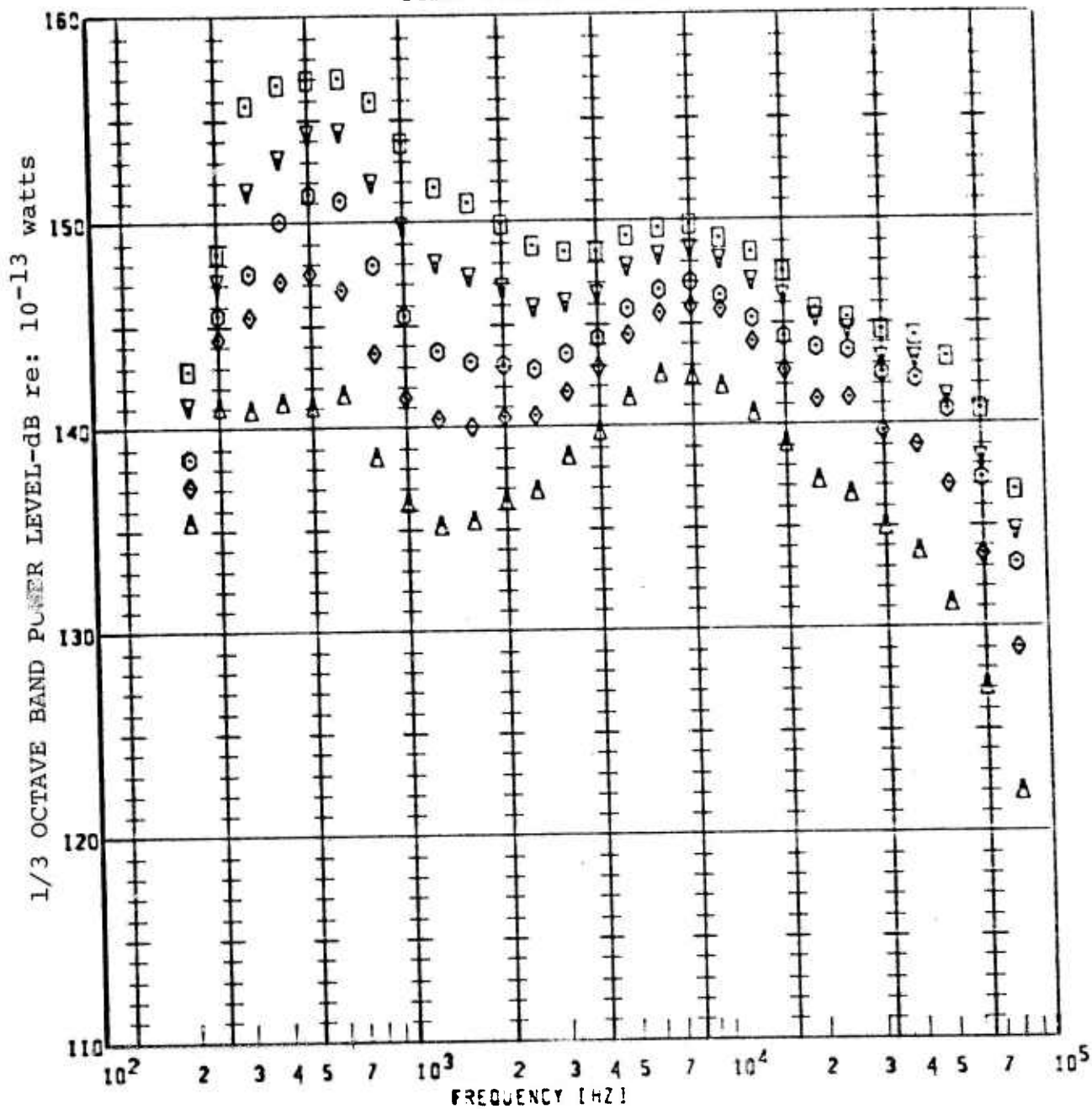
R.H. = 24%

SCALE MODEL $A_8 = 13.6 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
9	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.5	"	2437		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

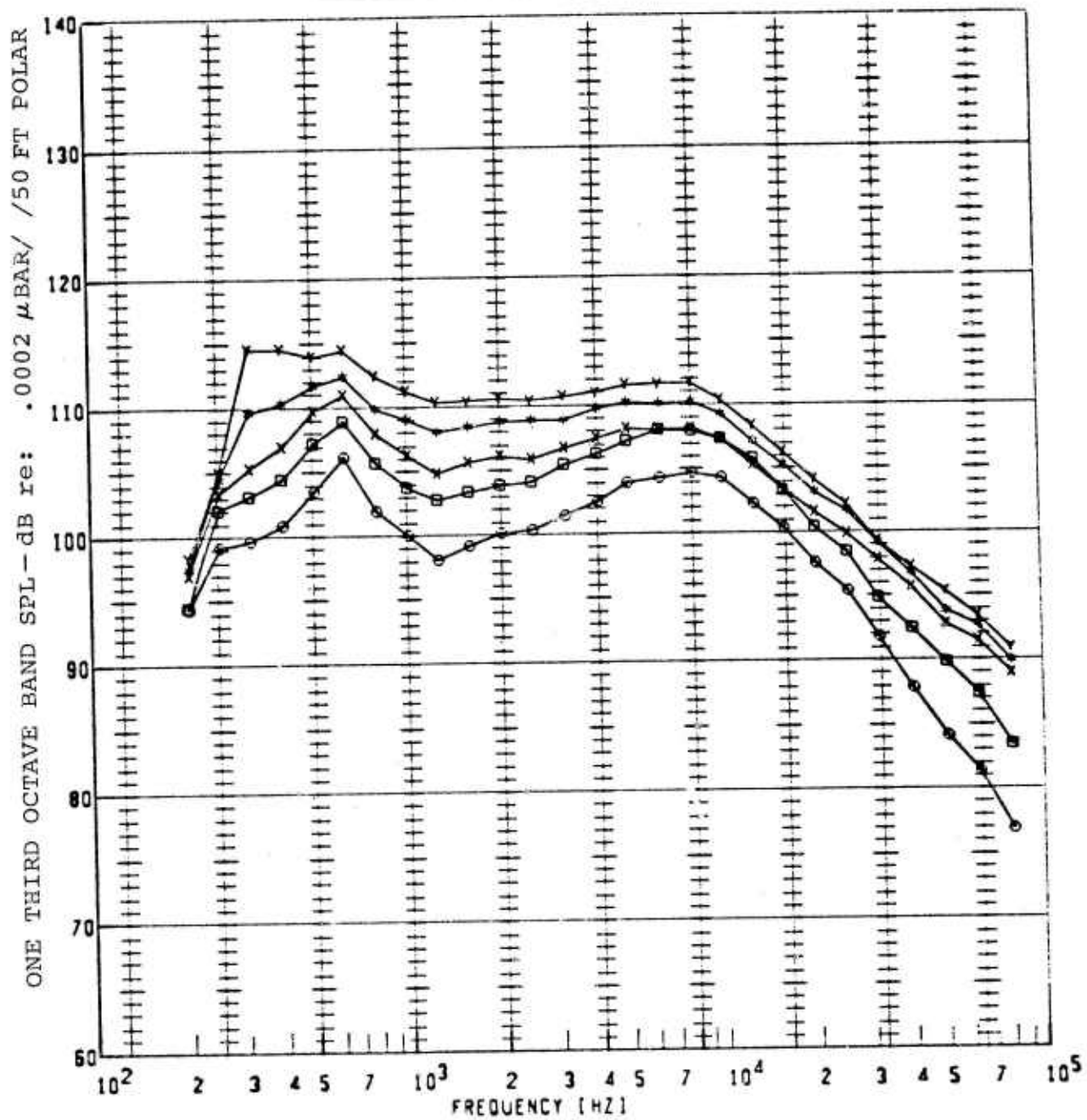


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	009	2.00	1150°F
◇	009	2.50	1150
○	009	3.00	1150
▽	009	3.50	1150
□	009	4.00	1150

NOZZLE: 19T-3.3AR-CPA-ET/RC
 $A_8 = 13.6 \text{ IN.}^2$

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

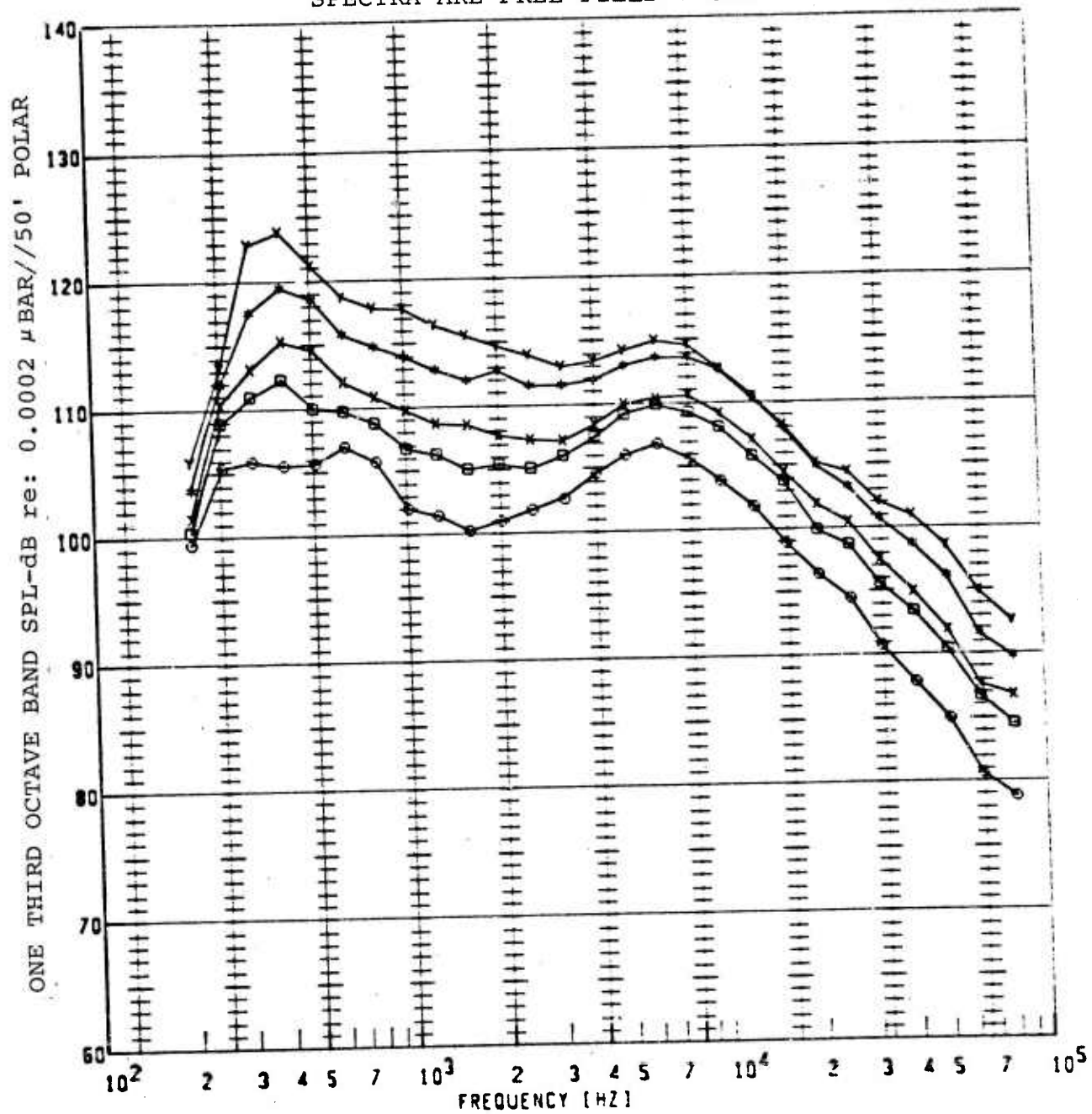


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
o	009G	1150°F	2.000	110	50FP	115.3
□	009G	1150	2.500	↓	50FP	118.7
x	009G	1150	3.000		50FP	120.1
*	009G	1150	3.500		50FP	122.4
y	009G	1150	4.000		50FP	124.5

NOZZLE: 19T-3.3AR-CPA-ET-/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

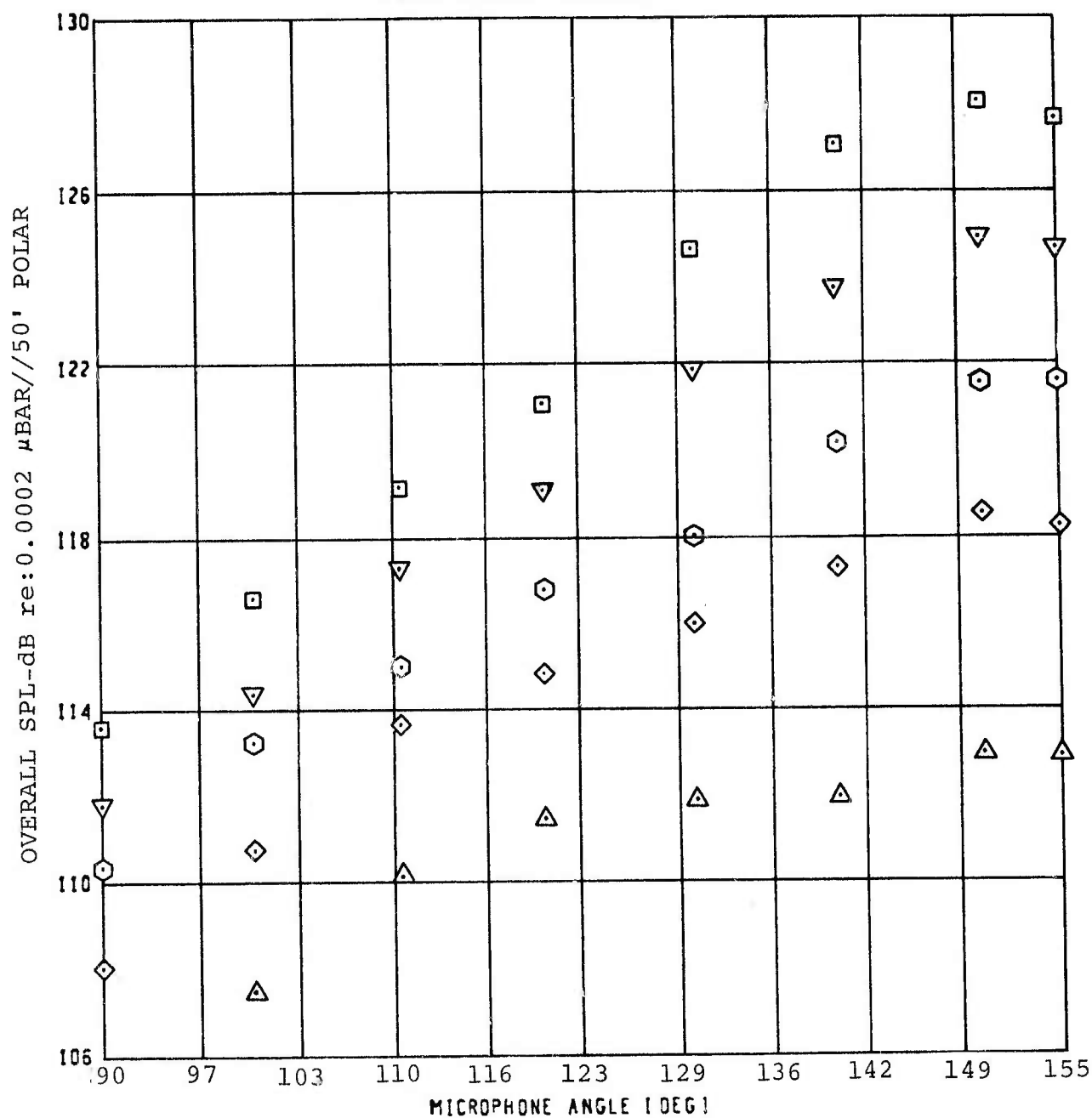


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	CAS ² (%)
○	009G	1150°F	2.000	130°	SCFP	117.3
□	009G	1150	2.500		SCFP	121.3
x	009G	1150	3.000		SCFP	123.5
*	009G	1150	3.500		SCFP	127.3
Δ	009G	1150	4.000		SCFP	130.4

NOZZLE: 19T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

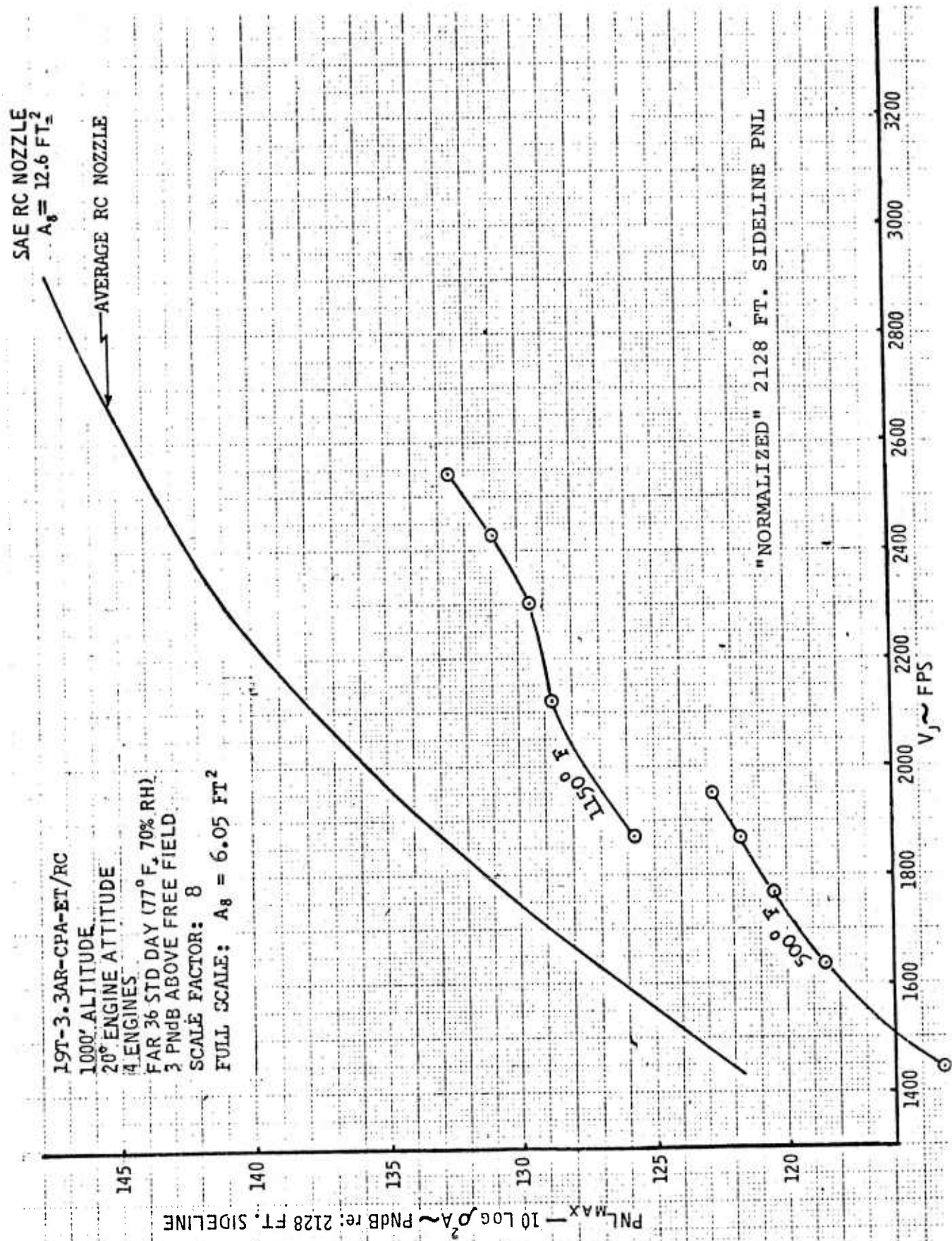
FREE FIELD VALUES

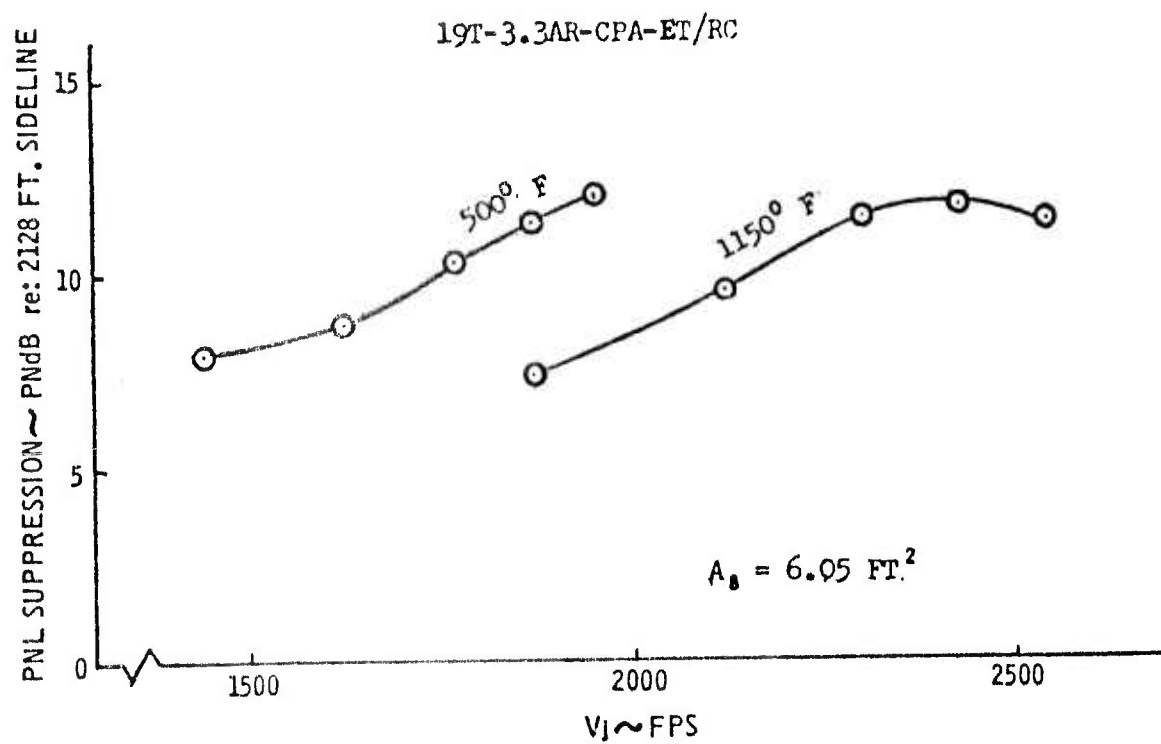


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	009	2.00	1150°F
◇	009	2.50	1150
○	009	3.00	1150
▽	009	3.50	1150
□	009	4.00	1150

NOZZLE: 19T-3.3AR-CPA-ET/RC

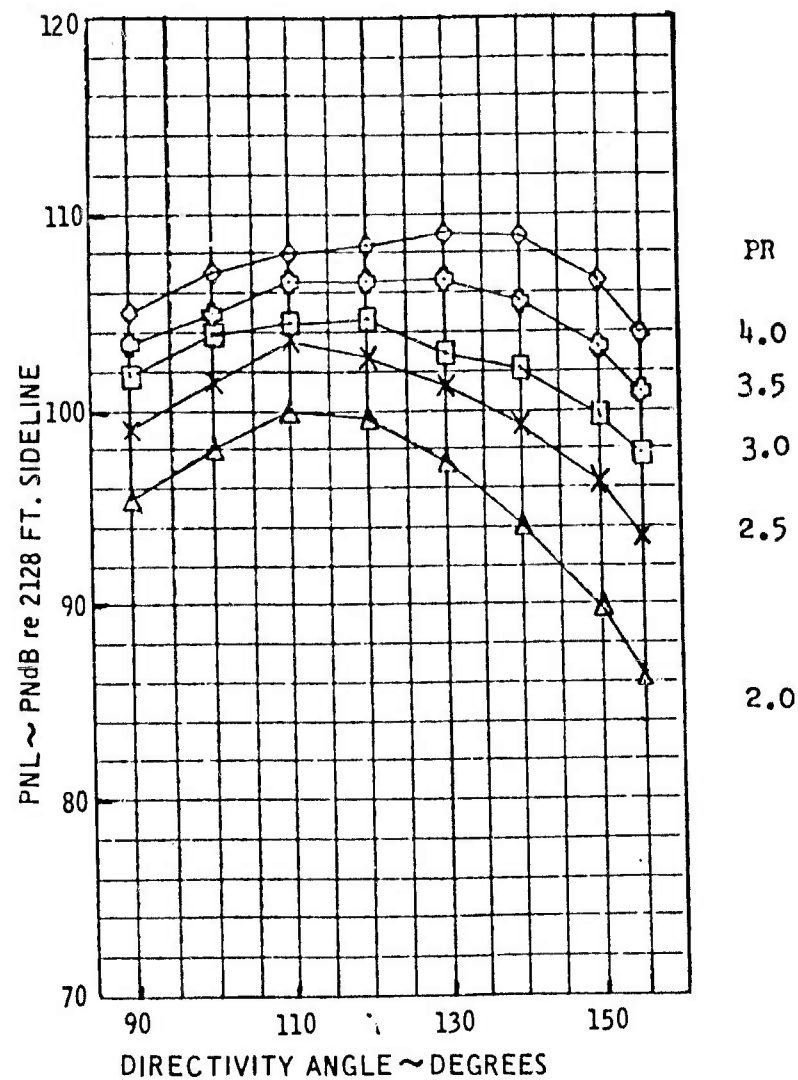
OASPL BEAM PATTERNS





PEAK PNL SUPPRESSION VALUES

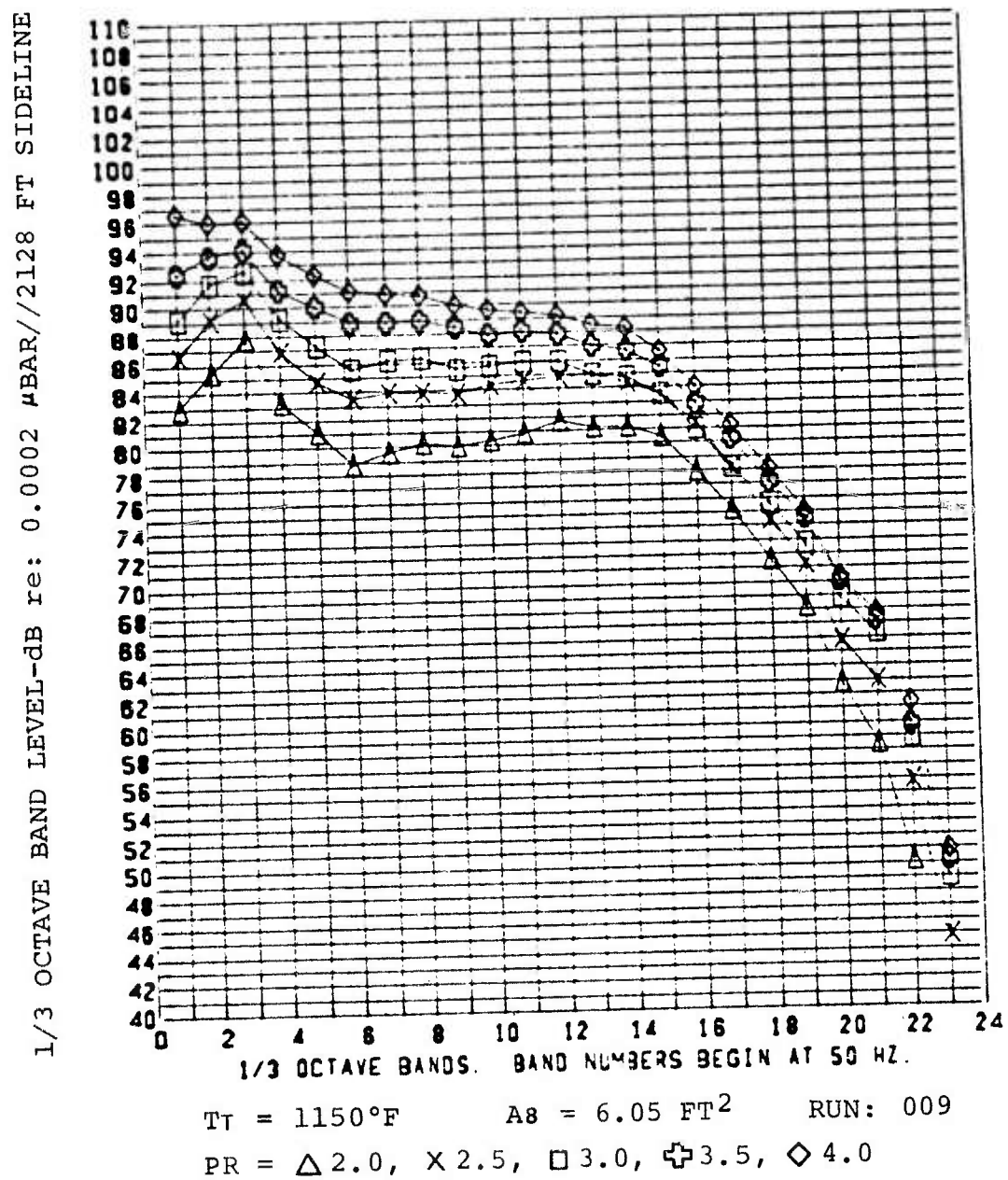
NOZZLE: 19T-3.3AR-CPA-ET/RC



RUN 009
 $T_T = 1150^{\circ} F$ $A_8 = 6.05 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

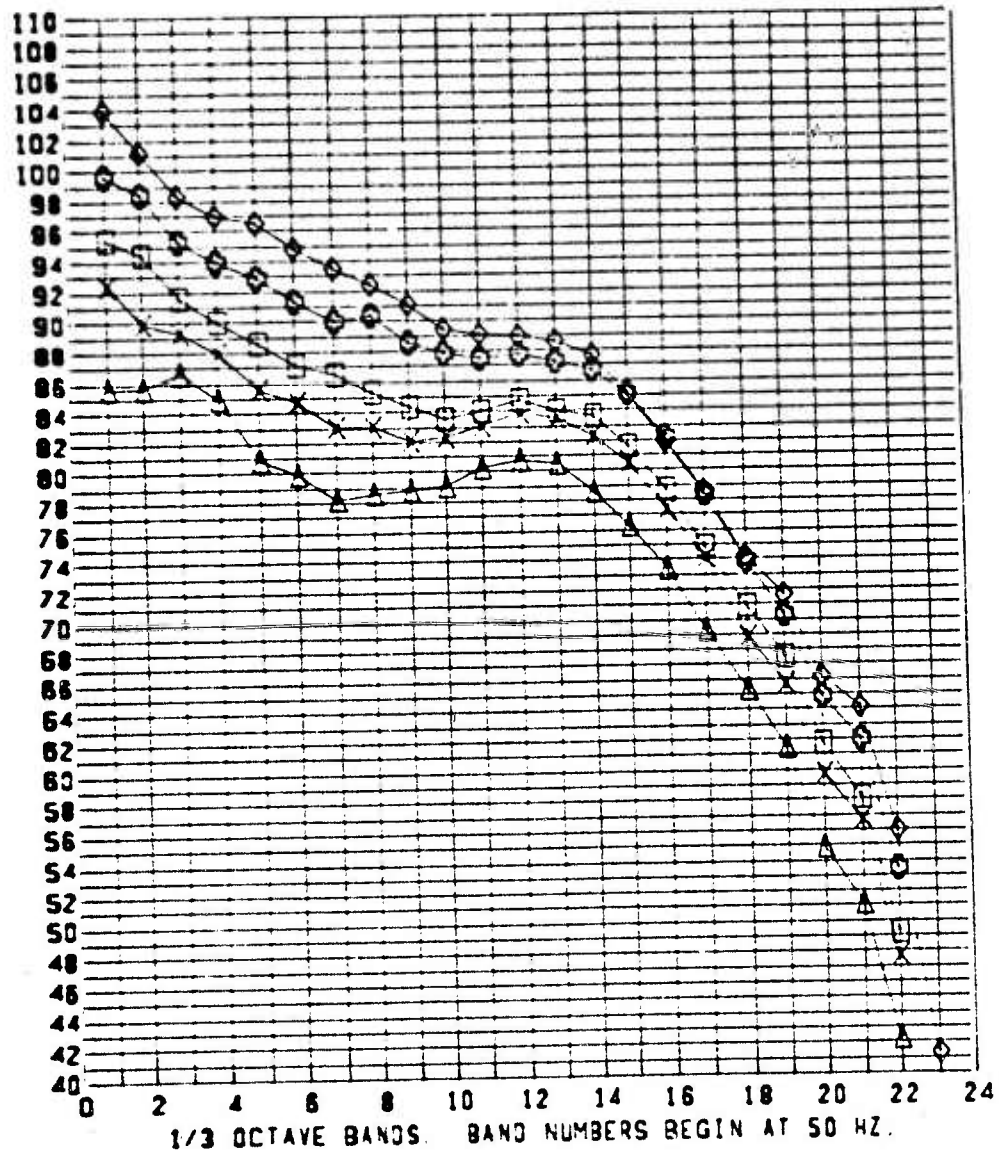


NOZZLE: 19T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



$T_t = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 009
 PR = $\triangle 2.0$, $\times 2.5$, $\square 3.0$, $+ 3.5$, $\diamond 4.0$

NOZZLE: 19T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
 re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 19T-3.3AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 19, 1973

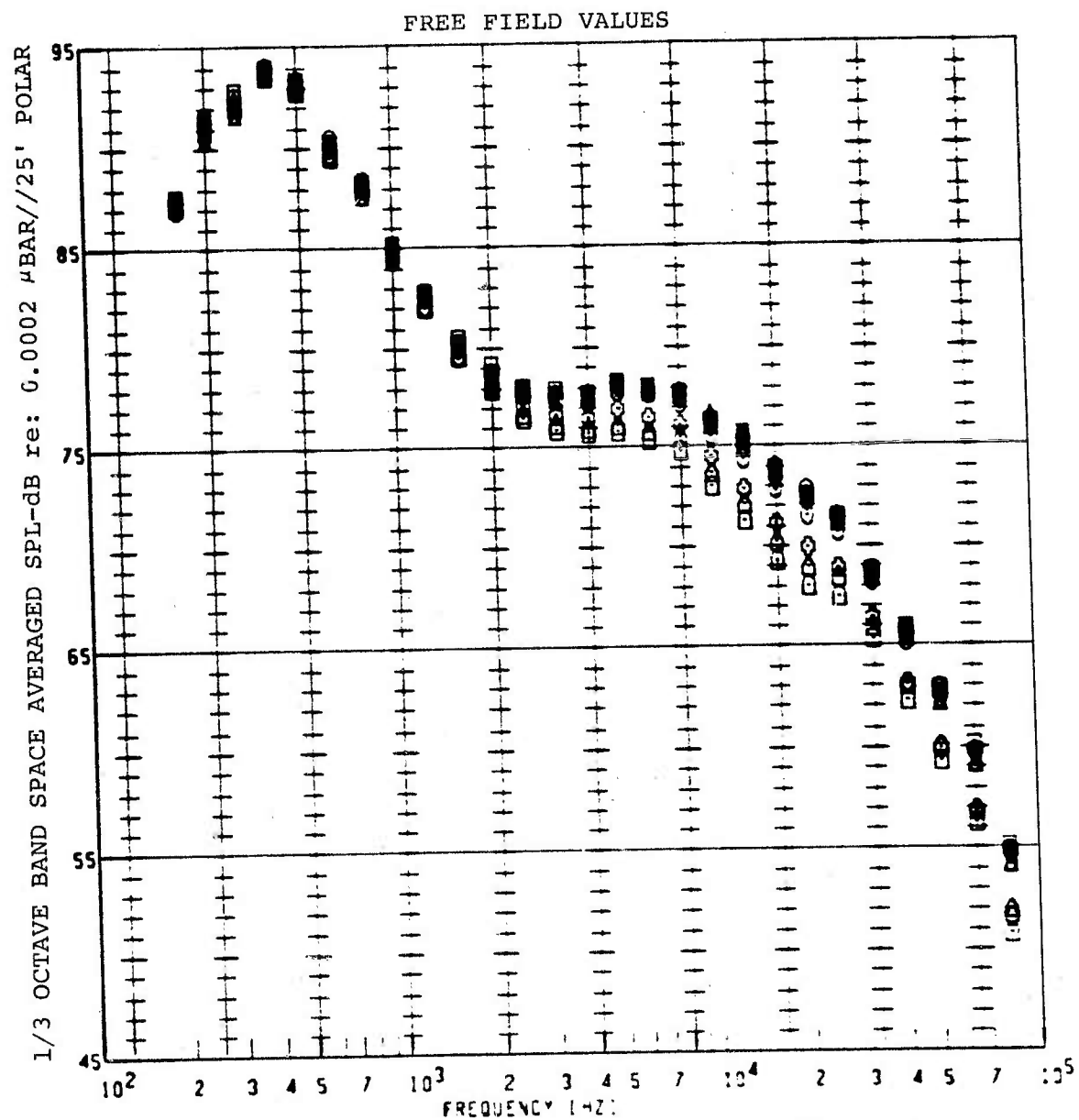
P_{AMB} = 29.92 in Hg **T_{AMB}** = 40°F **R.H.** = 83%

NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

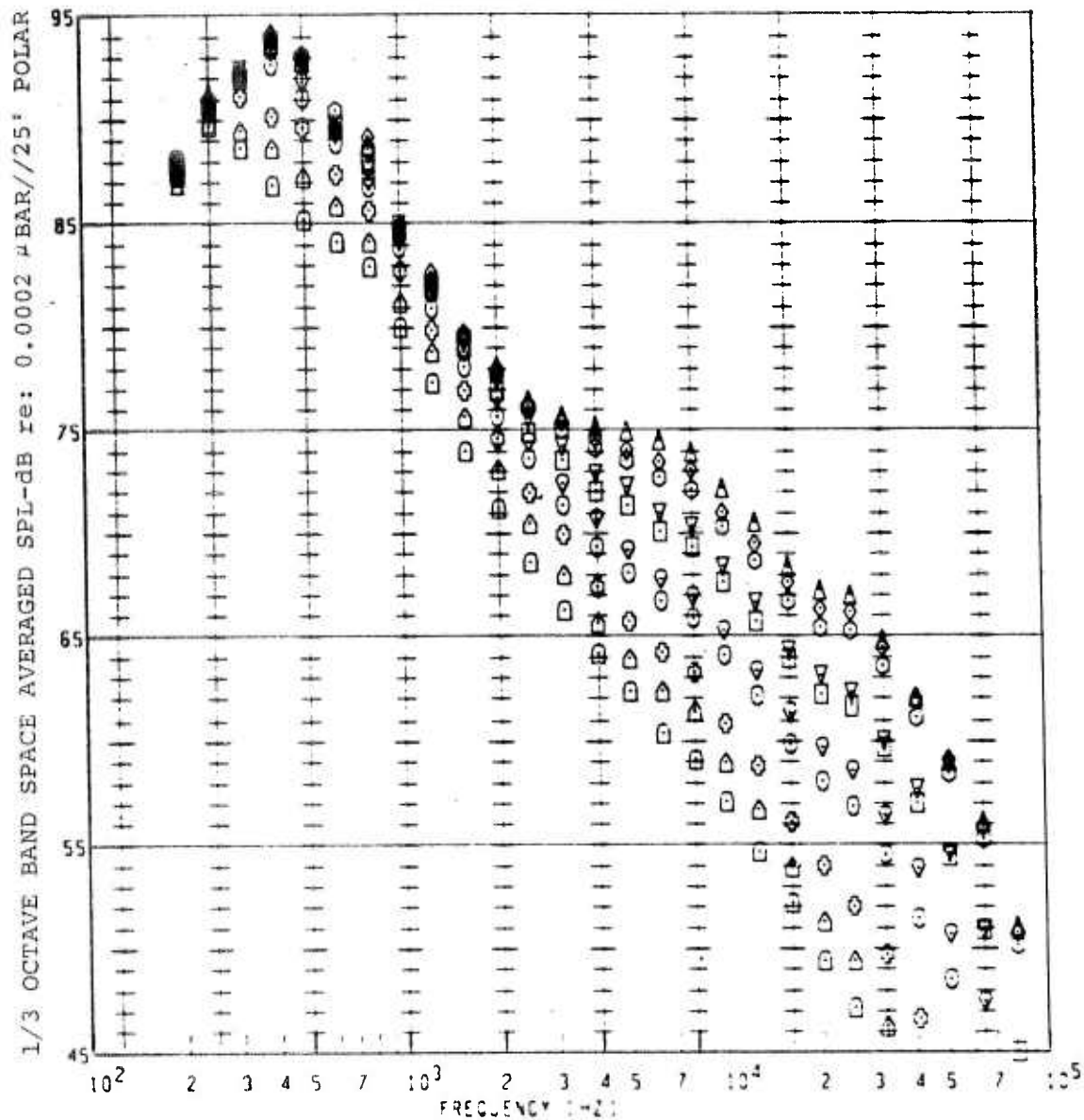
<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
99	0.0 x/D	9.0 in.		
100	0.25	9.0		
101	0.50	9.0		
102	0.75	10.0		
103	1.00	10.0		
104	1.25	10.5		
105	1.50	10.5		
106	1.75	11.0		
107	2.00	11.0		
108	2.25	11.5		
109	2.50	11.5		
110	2.75	12.0		
111	3.0	13.0		
112	3.5	14.0		
113	4.0	15.0		
114	5.0	16.0		
115	6.0	18.0		
116	8.0	19.0		
117	10.0	21.0		
118	12.0	23.0		
119	14.0	25.0		
120	160	27.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC



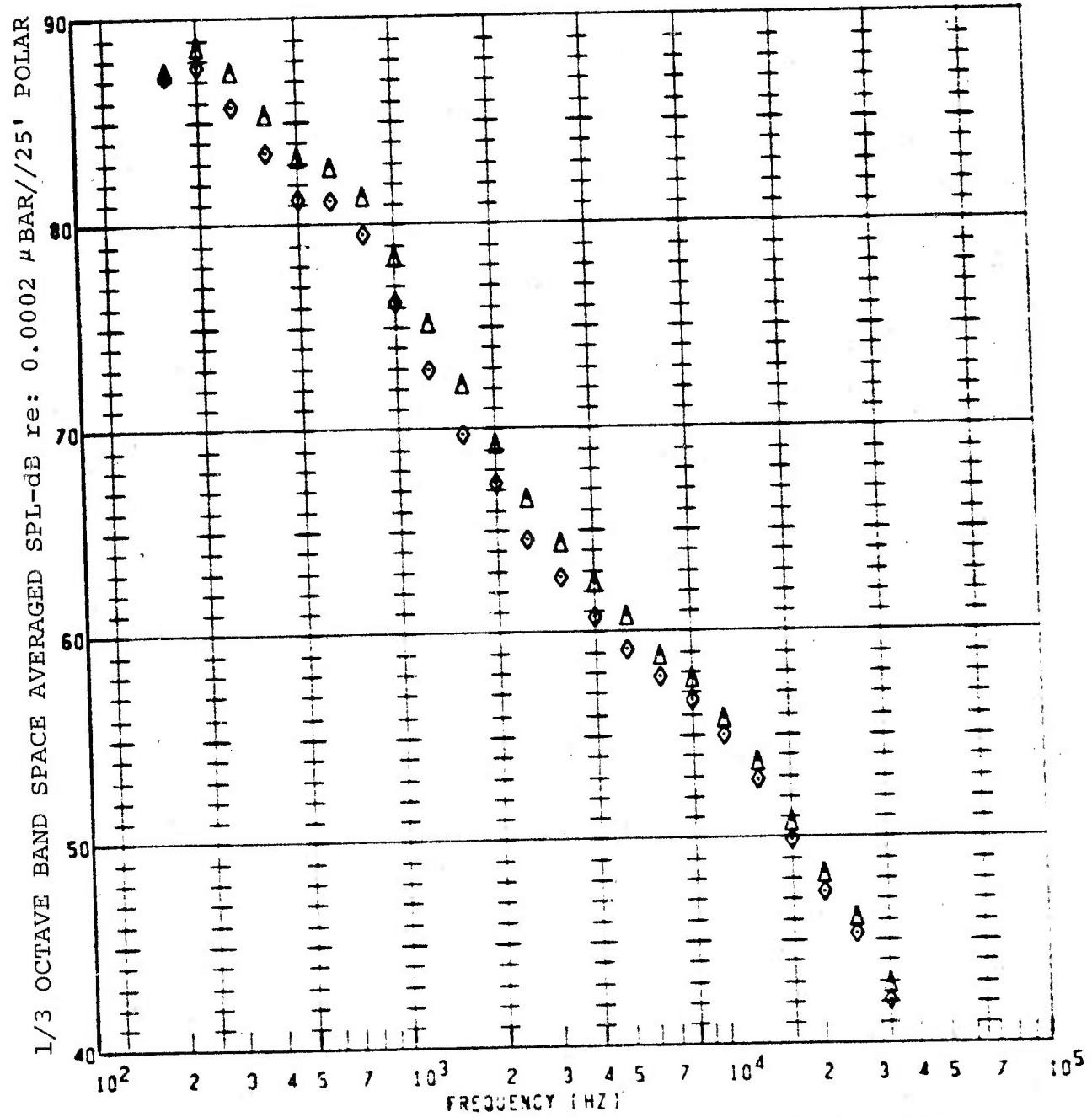
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	99	1150°F	3.000	0.00
◇	100	1150	3.000	0.25
○	101	1150	3.000	0.50
▽	102	1150	3.000	0.75
□	103	1150	3.000	1.00
◇	104	1150	3.000	1.25
○	105	1150	3.000	1.50
◇	106	1150	3.000	1.75
△	107	1150	3.000	2.0
□	108	1150	3.000	2.25

FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	TEST	PRESSURE RATIO	AXIAL LOCATION, x/D
△	109	1150°F	3.000	2.5
◇	110	1150	3.000	2.75
○	111	1150	3.000	3.0
▽	112	1150	3.000	3.5
□	113	1150	3.000	4.0
◇	114	1150	3.000	5.00
○	115	1150	3.000	6.0
◇	116	1150	3.000	8.0
△	117	1150	3.000	10.0
□	118	1150	3.000	12.0

FREE FIELD VALUES

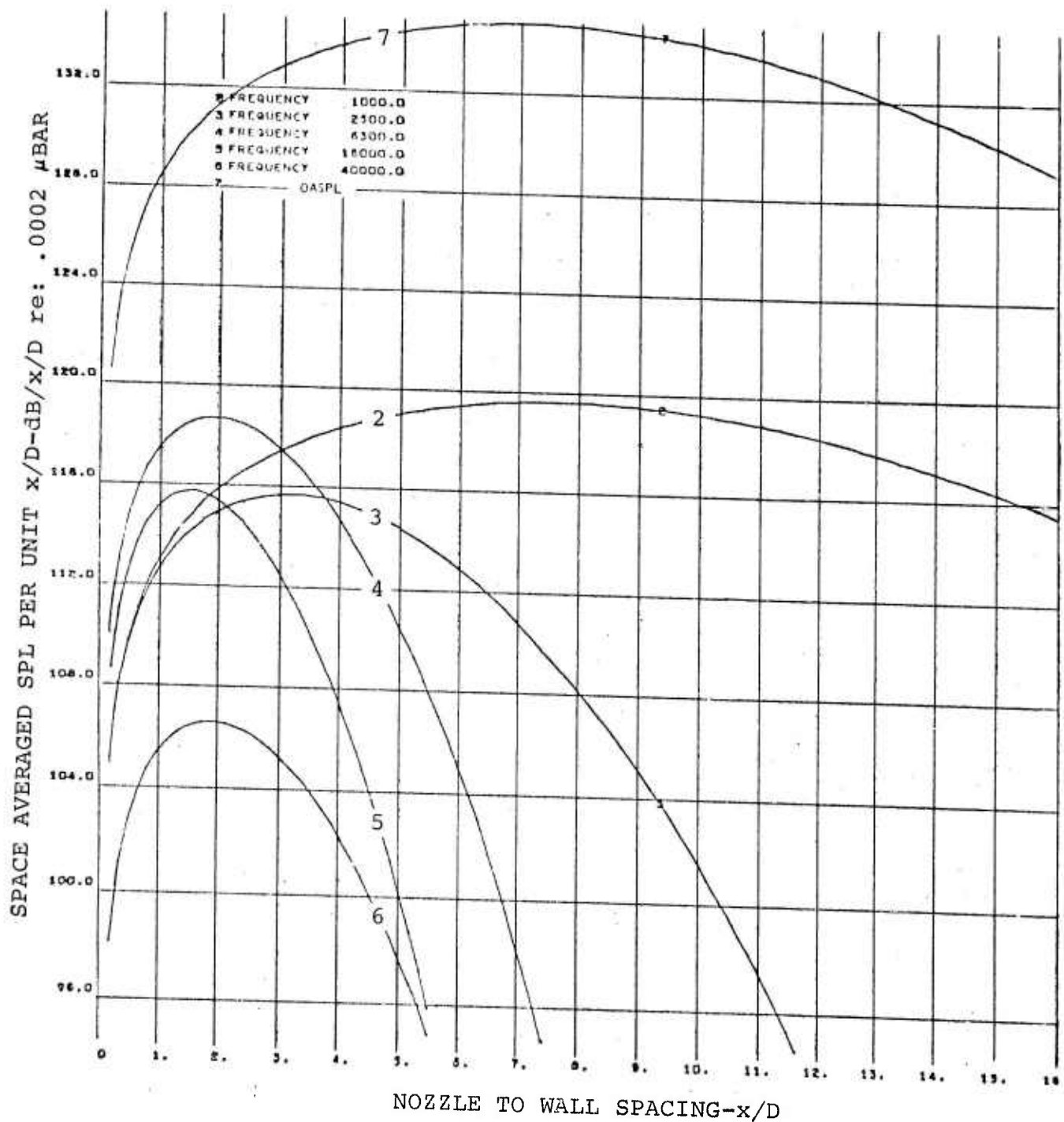


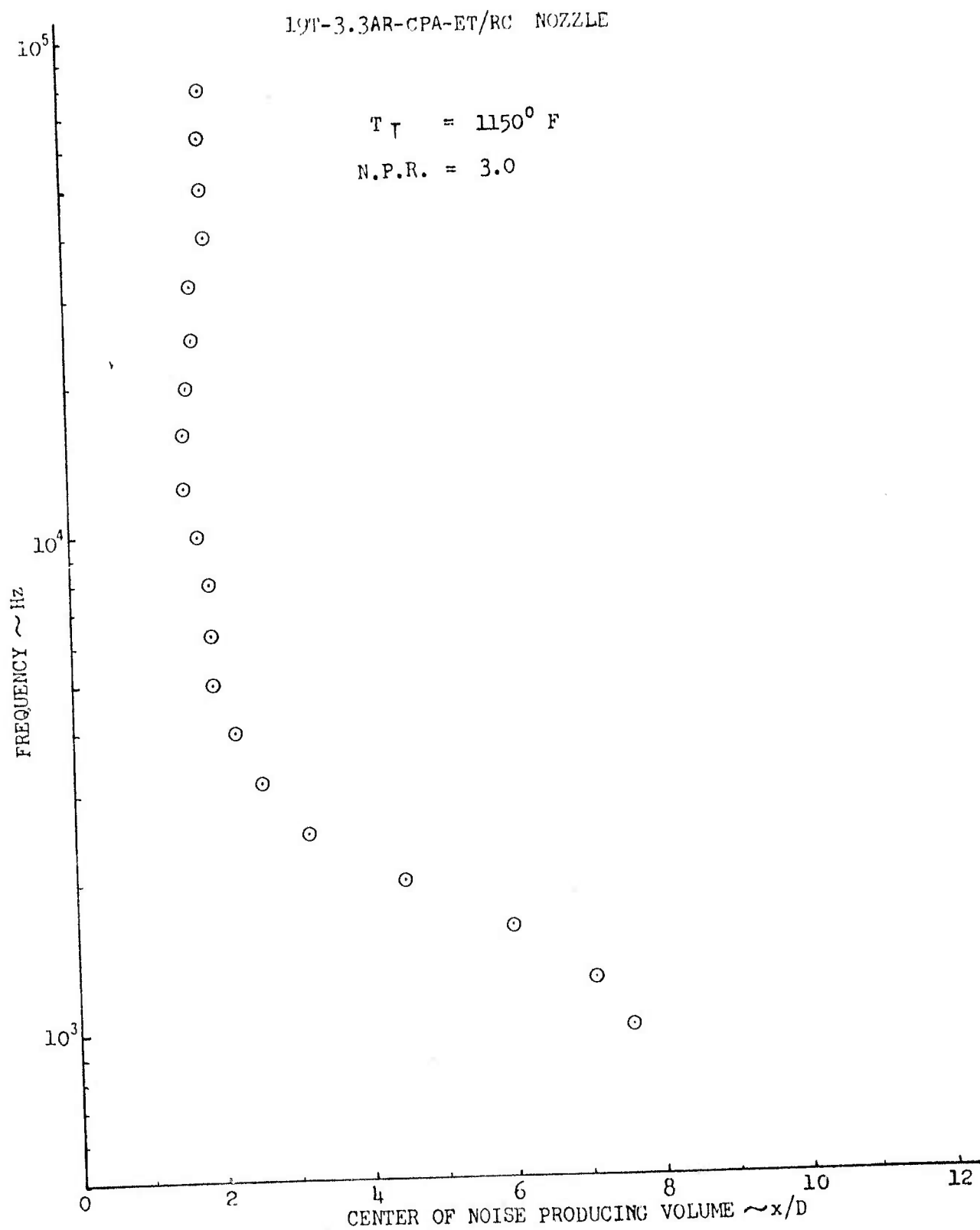
PLOT
SYMBOL

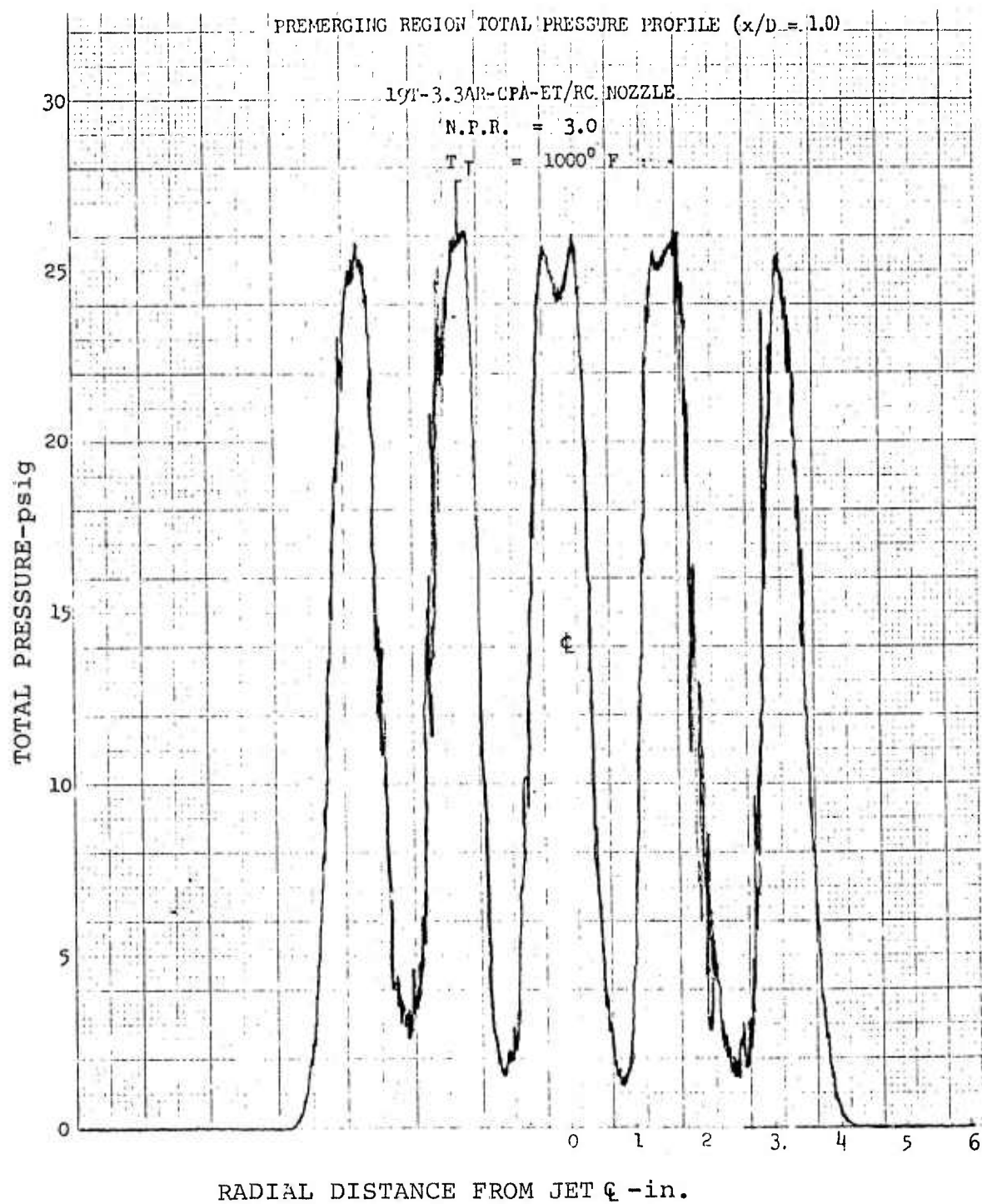
RUN
NUMBER

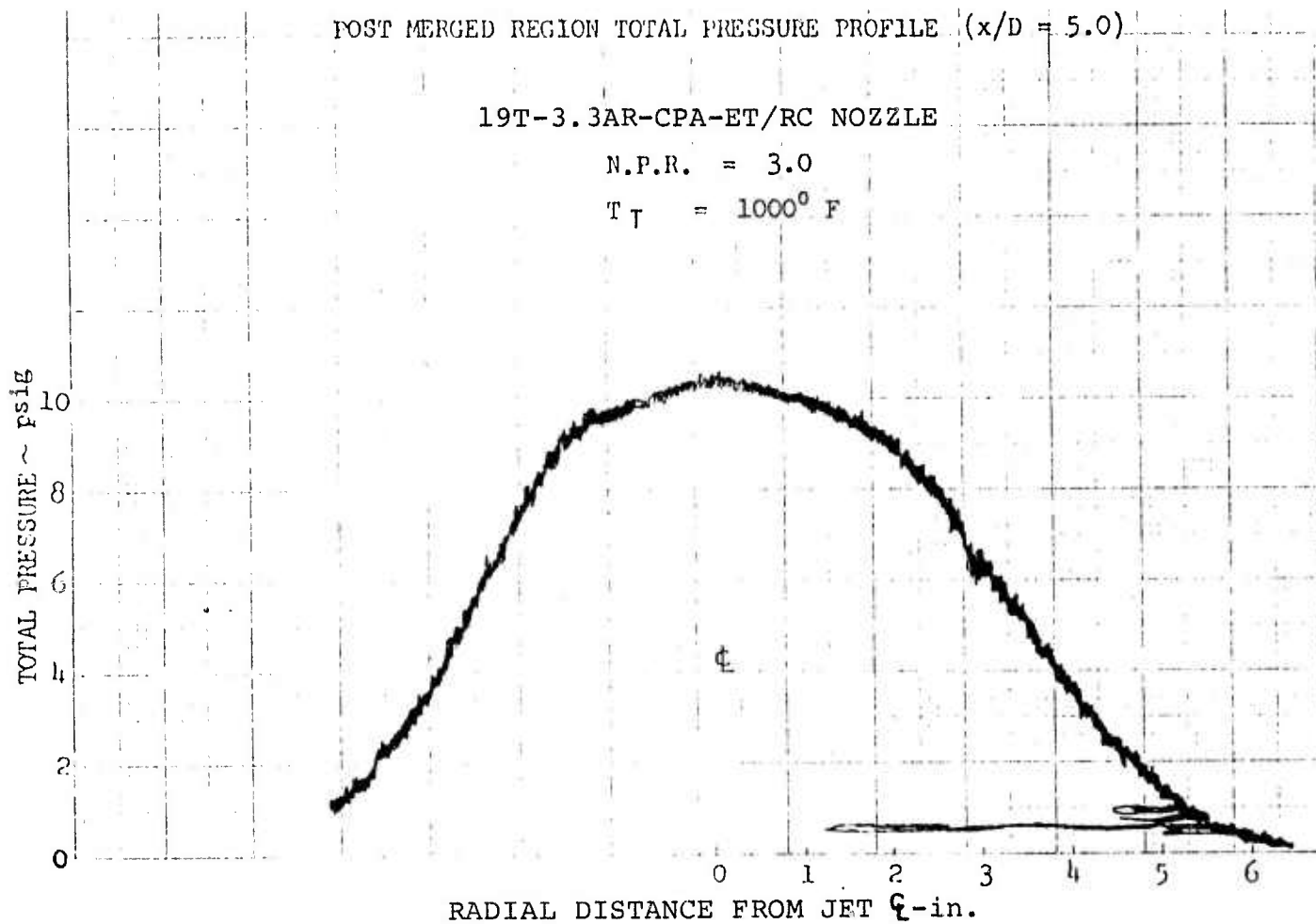
TEMP
1150°F
1150

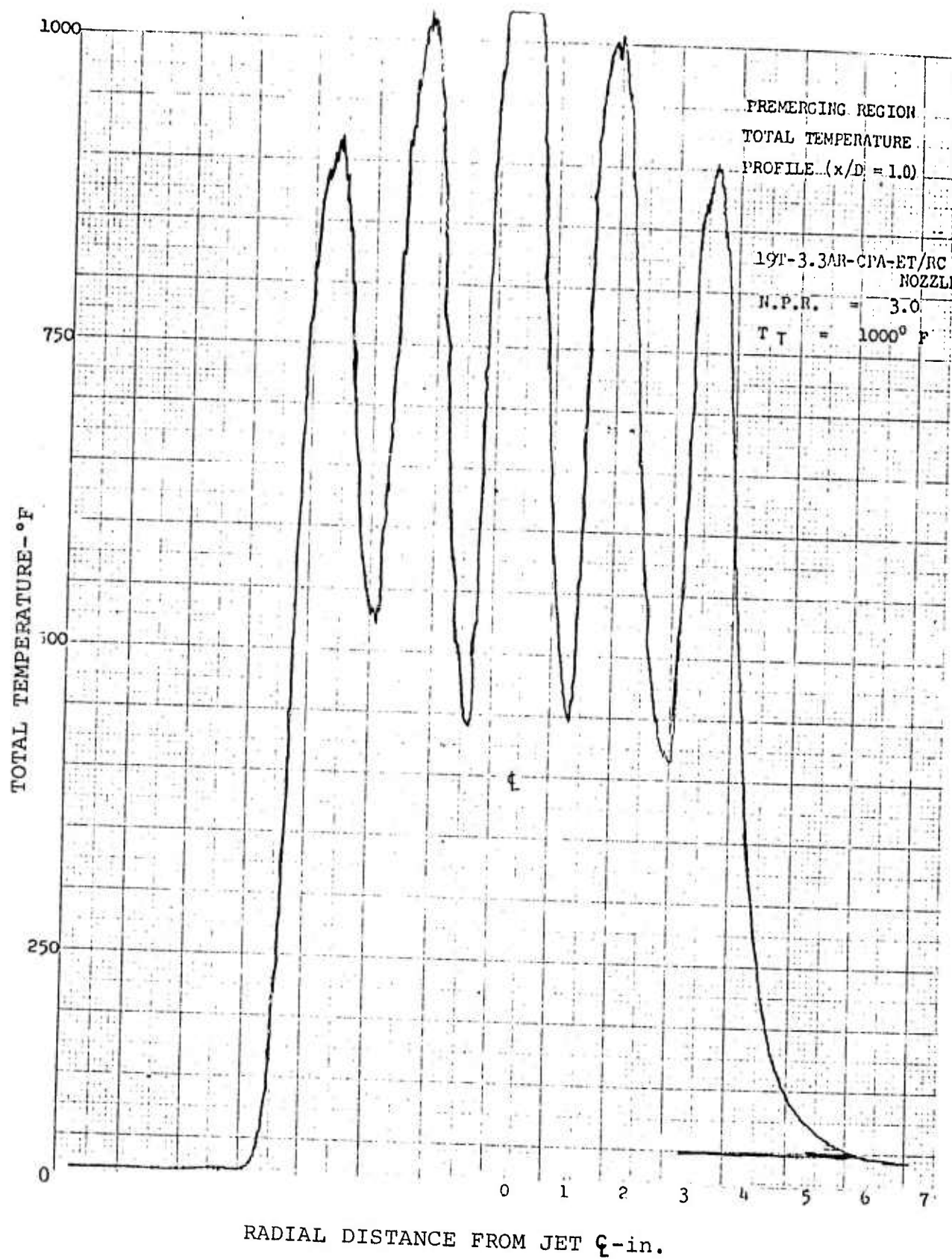
PRESSURE RATIO AXIAL
LOCATION, x/D
3.0 14.0
3.0 16.0

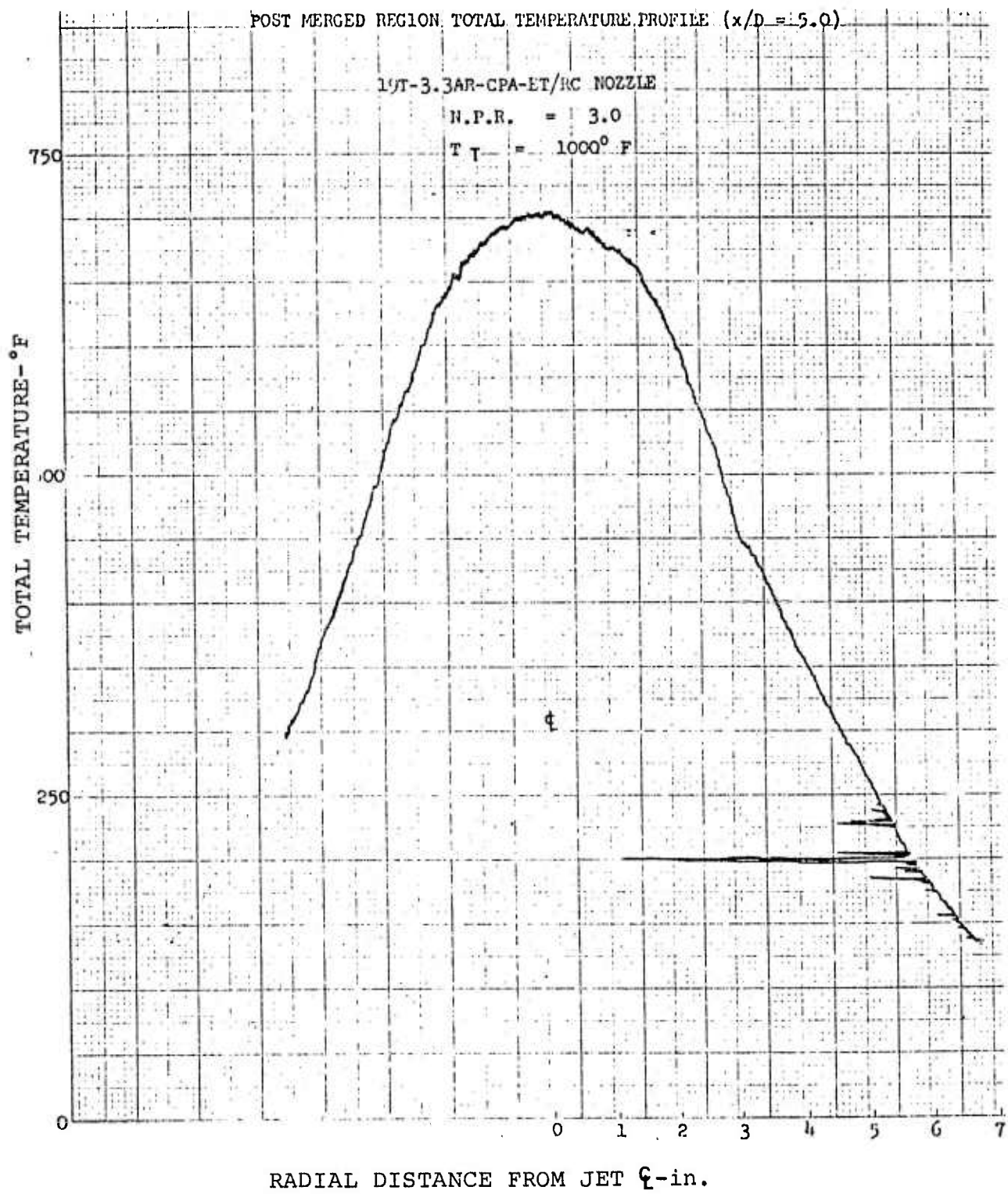


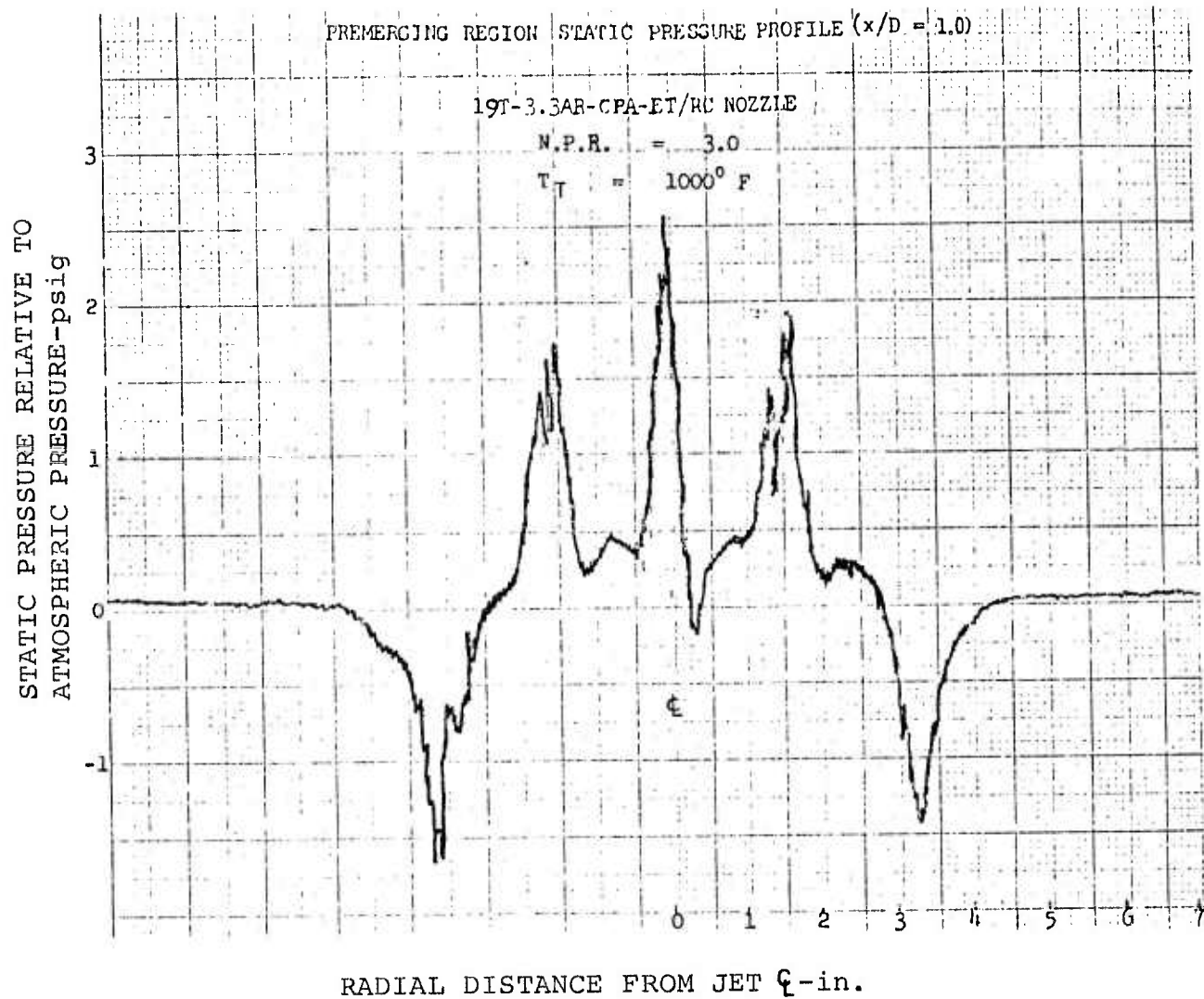


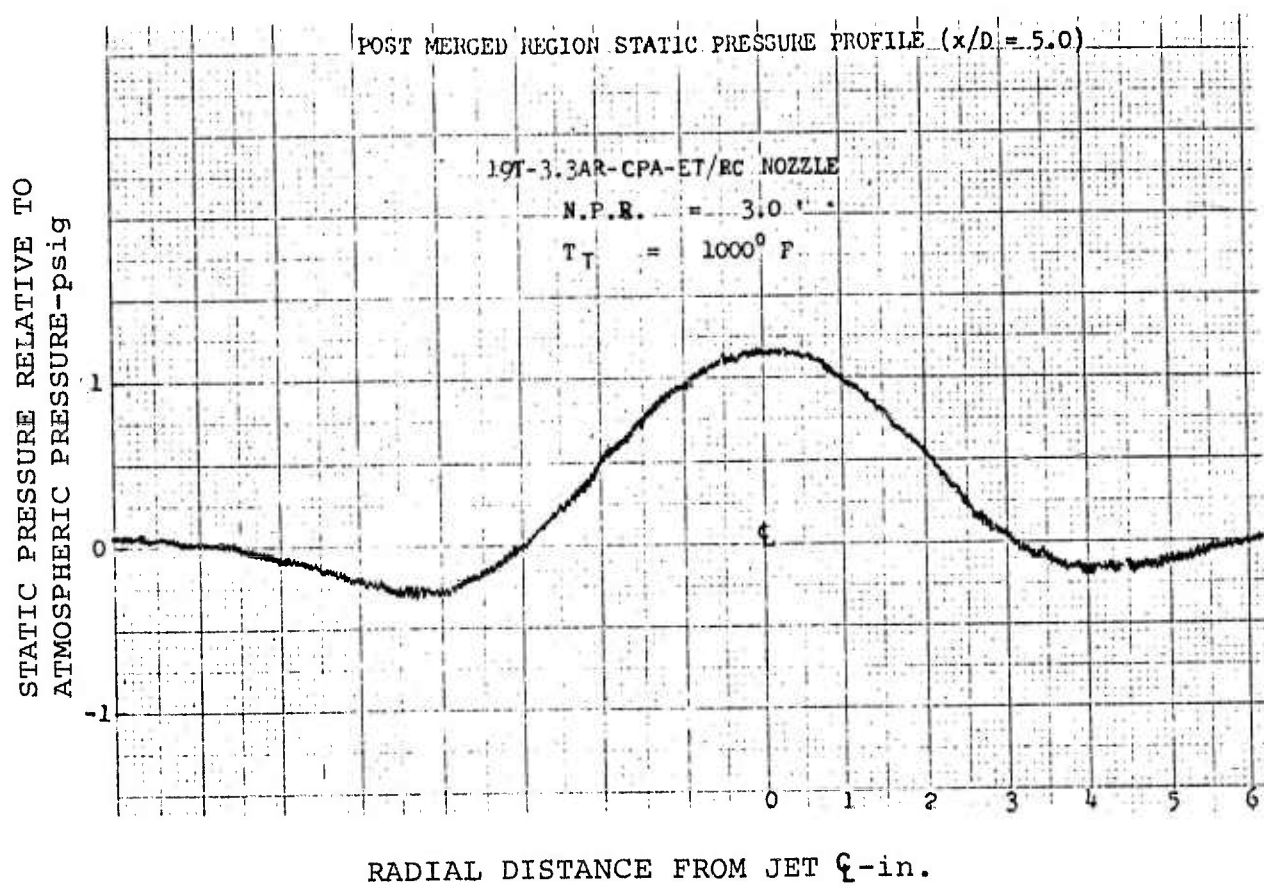


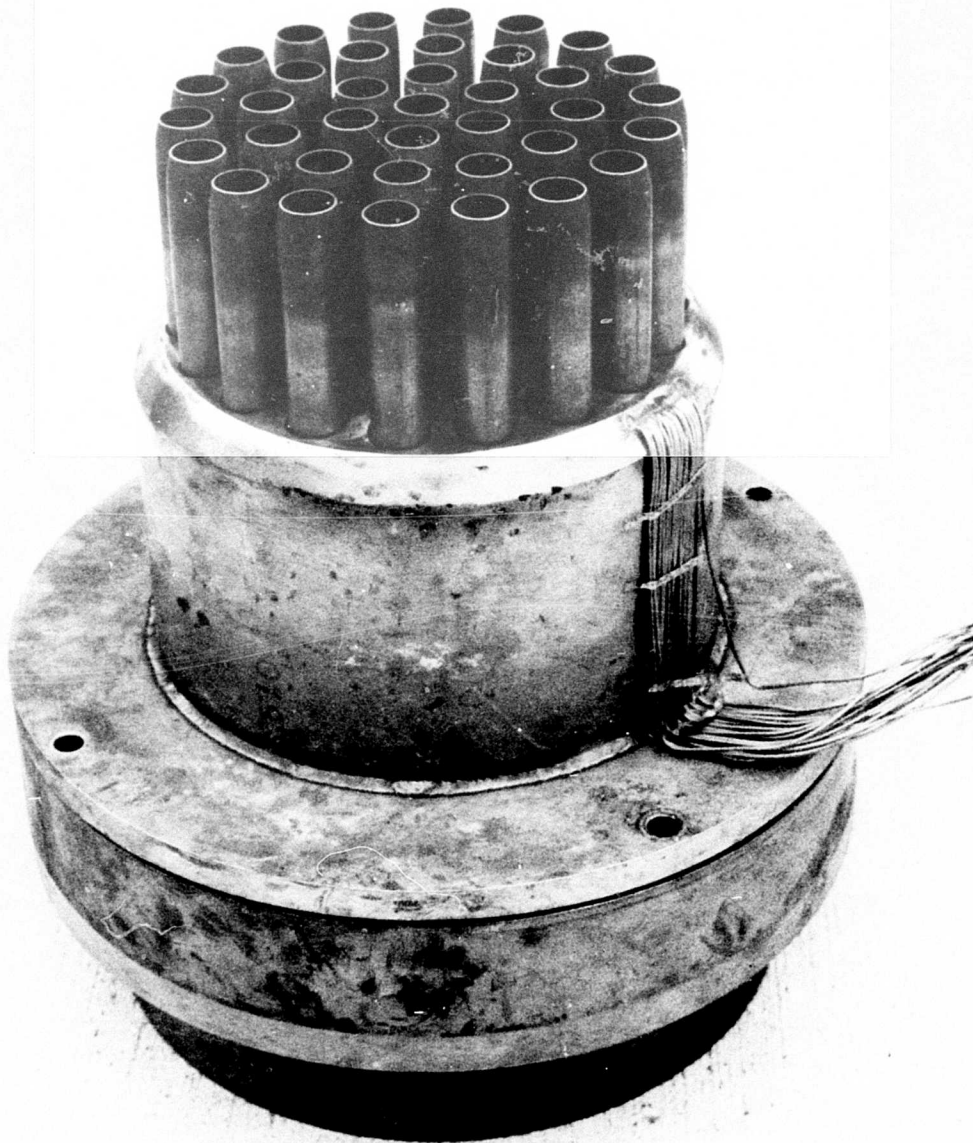




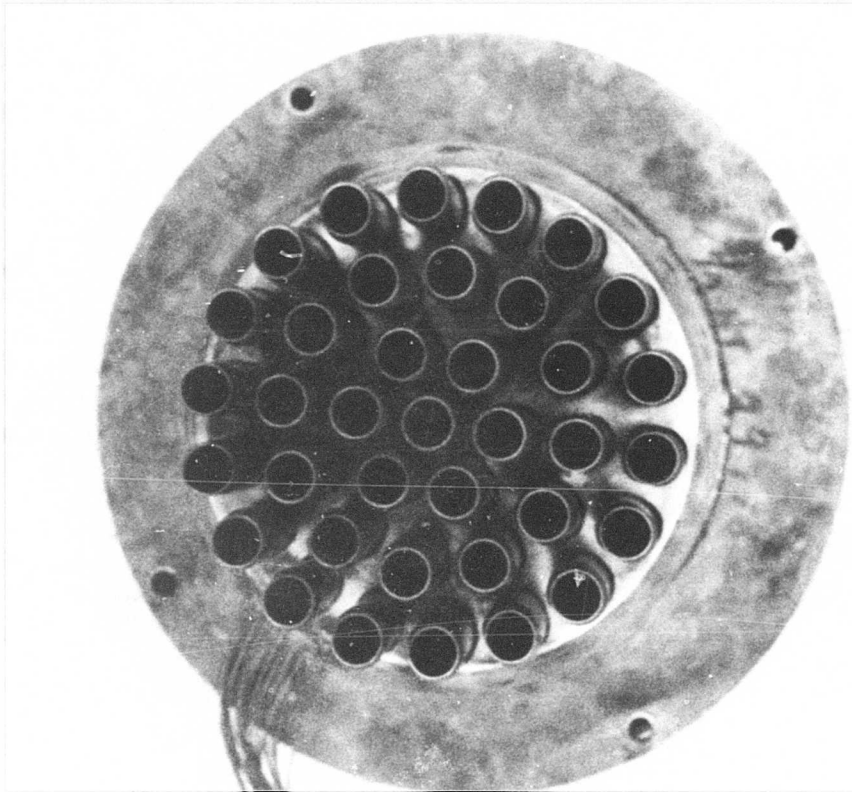








37T-3.3AR-CPA-ET/RC NOZZLE



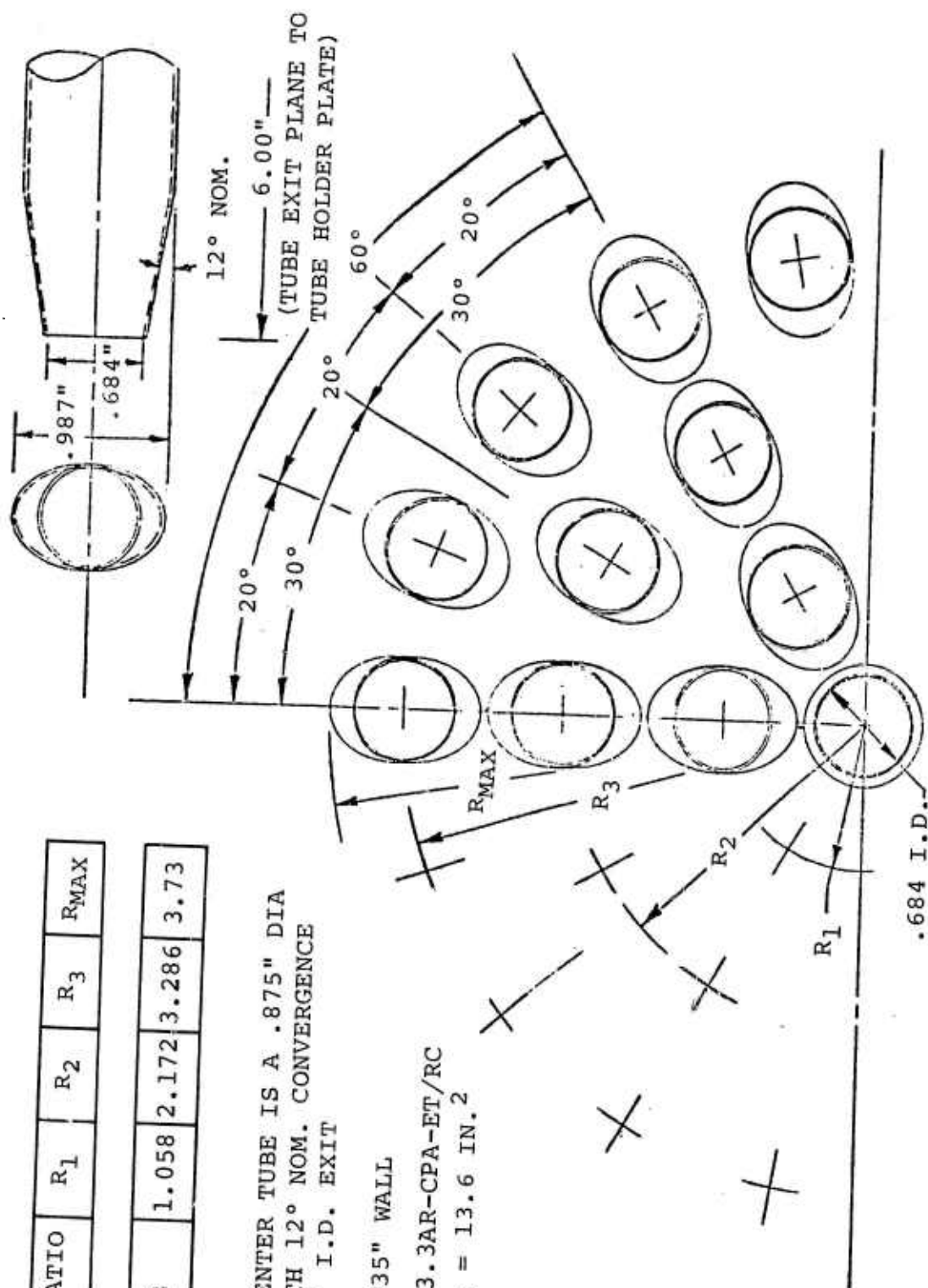
37T-3.3AR-CPA-ET/RC NOZZLE

3.3	1.058	2.172	3.286	3.73
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NOTE: CENTER TUBE IS A .875" DIA
TUBE WITH 12° NOM. CONVERGENCE
TO .684" I.D. EXIT

MAT'L-.035" WALL

37T-3. 3AR-CPA-ET/RC

$$A_8 = 13.6 \text{ IN.}^2$$


37 TUBE - AREA RATIO 3.3, ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-ET/RC

FACILITY: HNTF

DATE: 6-11-73

T_{AMB} = 60°F

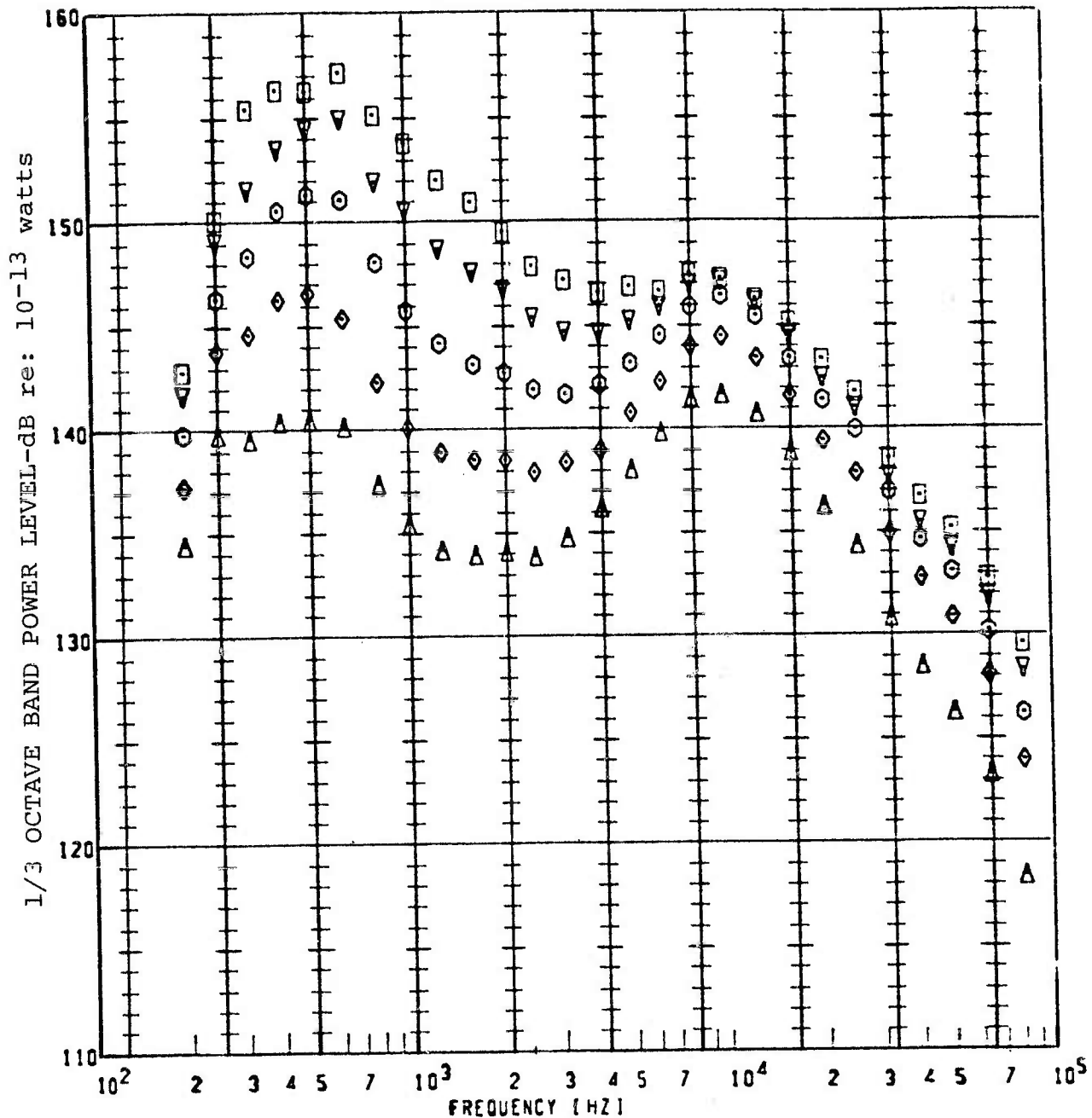
R.H. = 58%

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
6	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	3.5	"	2437		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

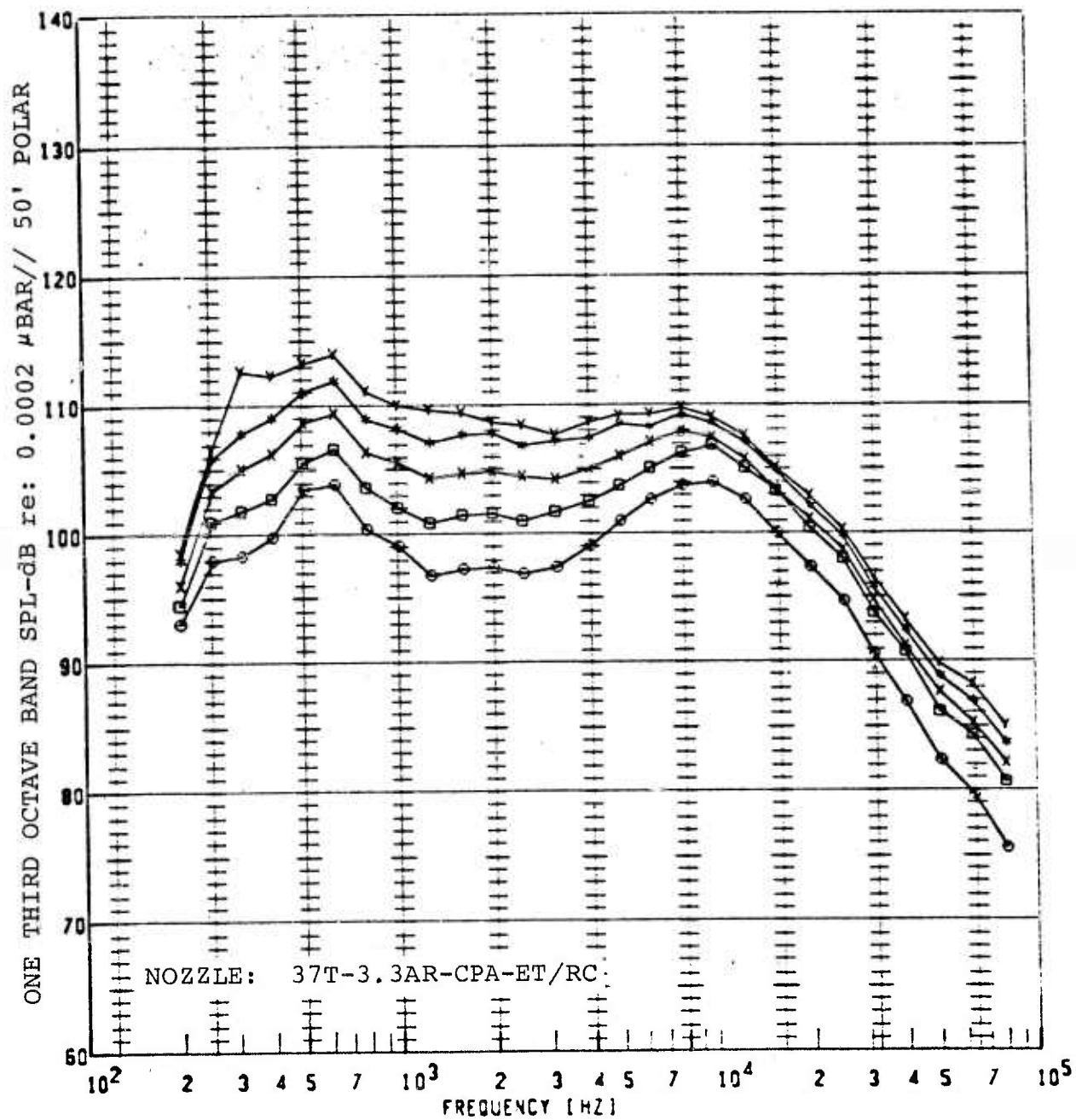


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	005	2.00	1150°F
◇	006	2.50	1150
○	006	3.00	1150
▽	005	3.50	1150
□	006	4.00	1150

NOZZLE: 37T-3.3AR-CPA-ET/RC

JET NOISE POWER SPECTRA

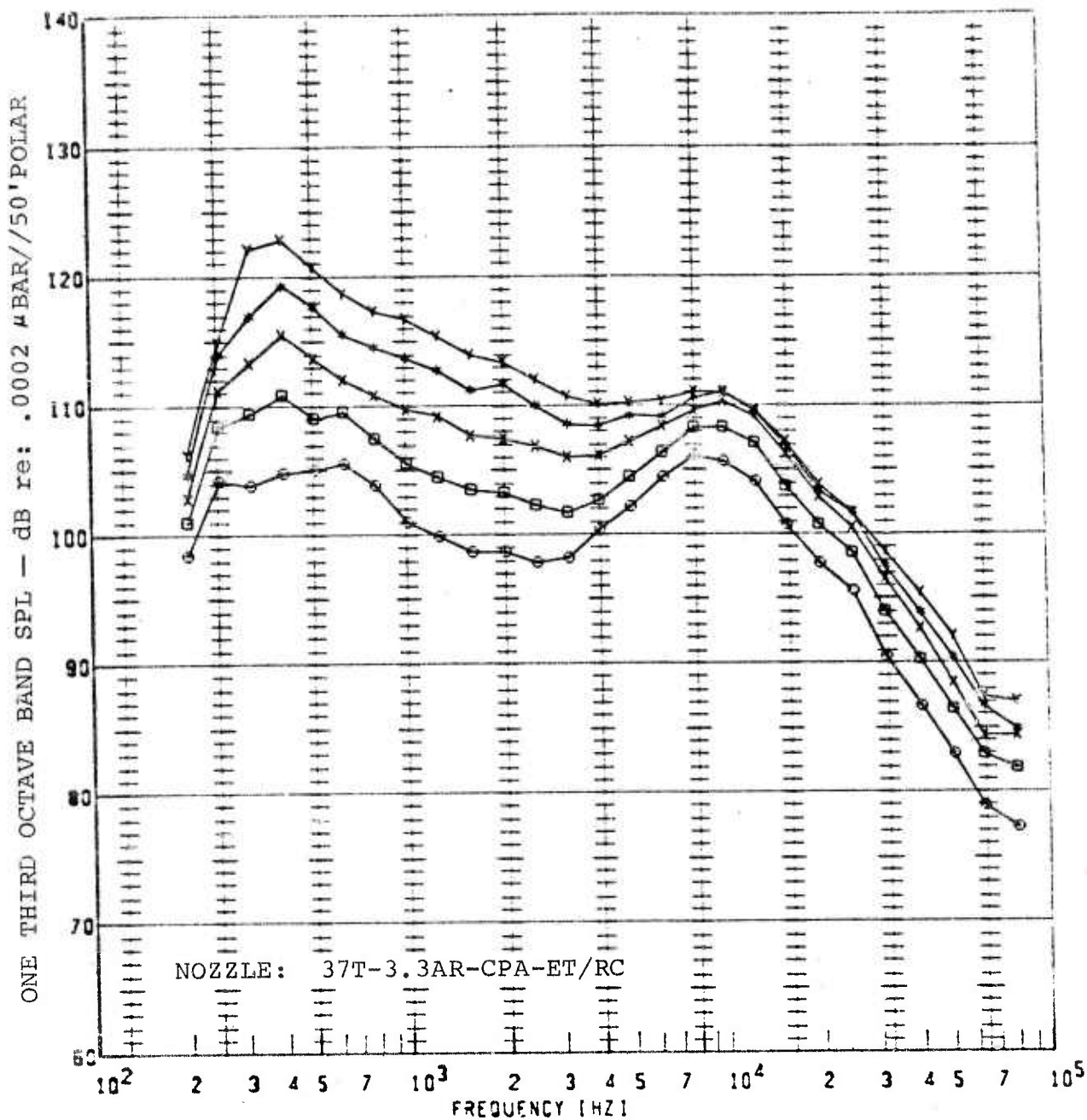
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	SASPL [dB]
○	0066	1150°F	2.000	110°	50FP	113.8
□	0056	1150	2.500	↓	50FP	115.8
×	0066	1150	3.000	↓	50FP	119.1
*	0066	1150	3.500	↓	50FP	121.3
△	0066	1150	4.000	↓	50FP	123.0

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

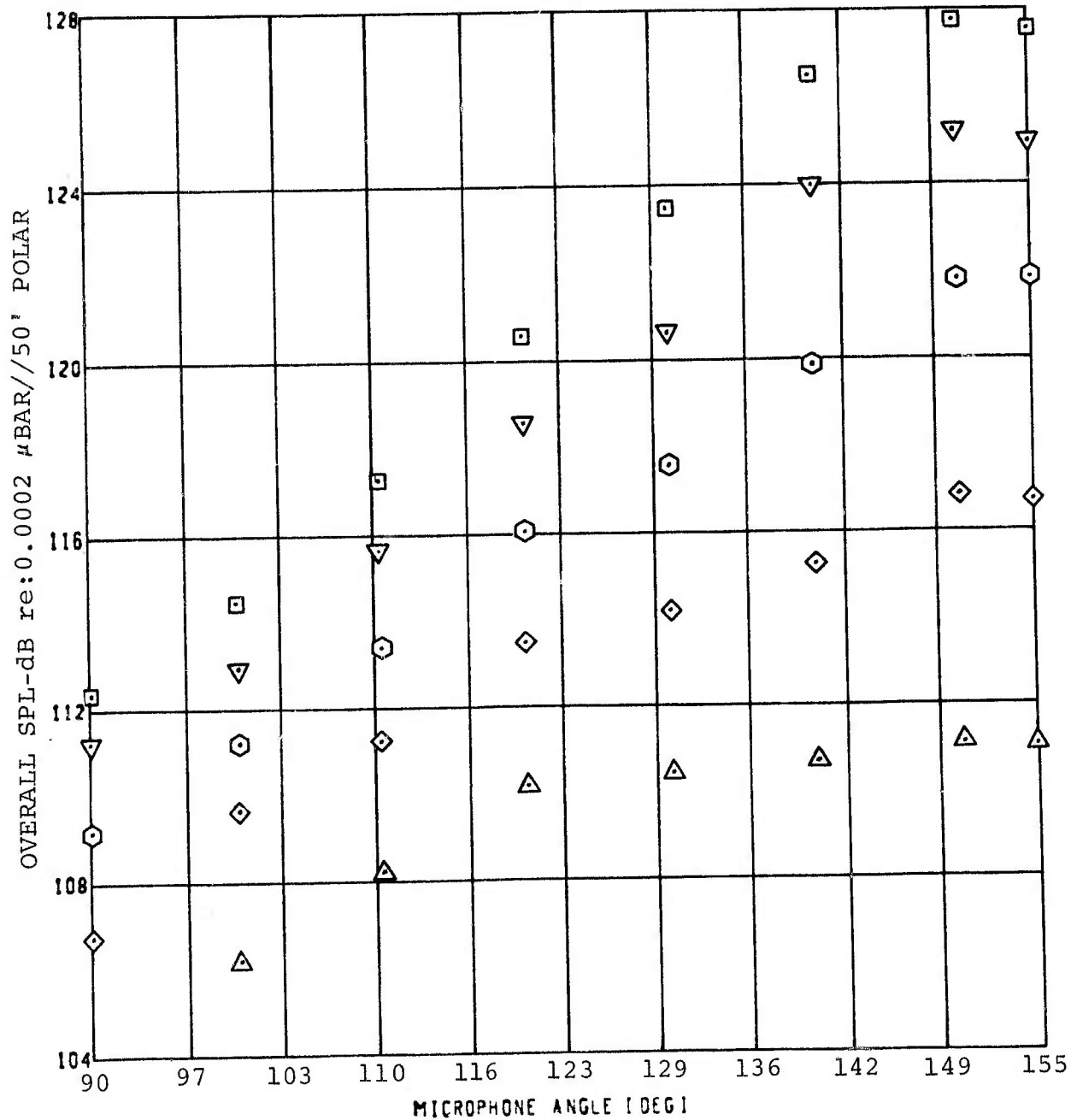
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [dB]
e	006G	1150°F	2.000	130°	50FP	116.1
g	006G	1150	2.500	↓	50FP	119.9
x	006G	1150	3.000	↓	50FP	123.3
*	006G	1150	3.500	↓	50FP	126.4
y	006G	1150	4.000	↓	50FP	129.4

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

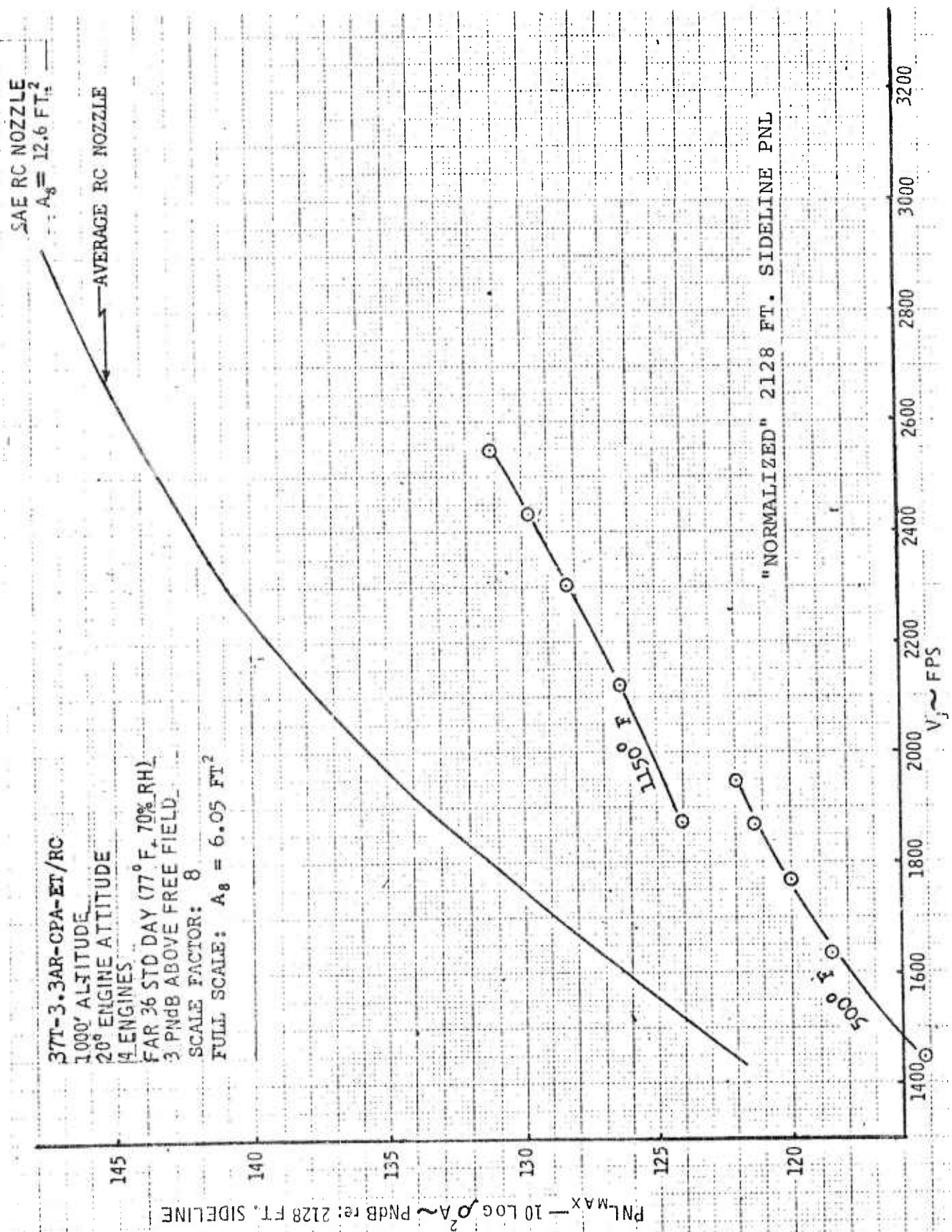
FREE FIELD VALUES



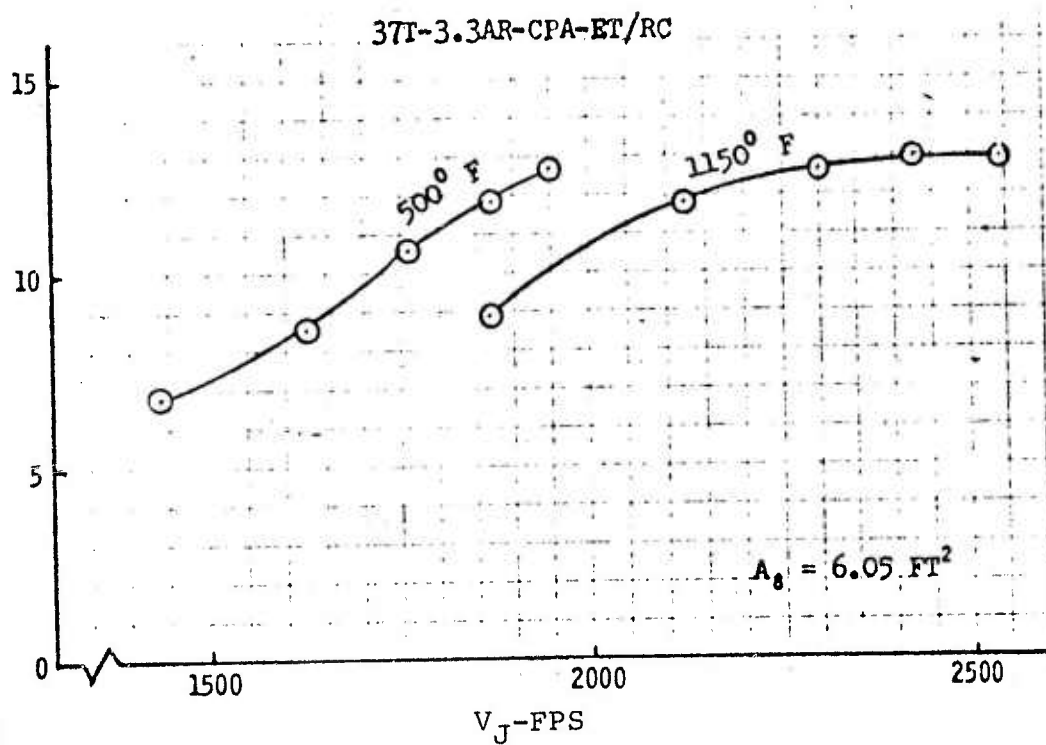
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	006	2.00	1150°F
◊	006	2.50	1150
○	006	3.00	1150
▽	006	3.50	1150
◻	006	4.00	1150

NOZZLE: 37T-3.3AR-CPA-ET/RC

OASPL BEAM PATTERNS

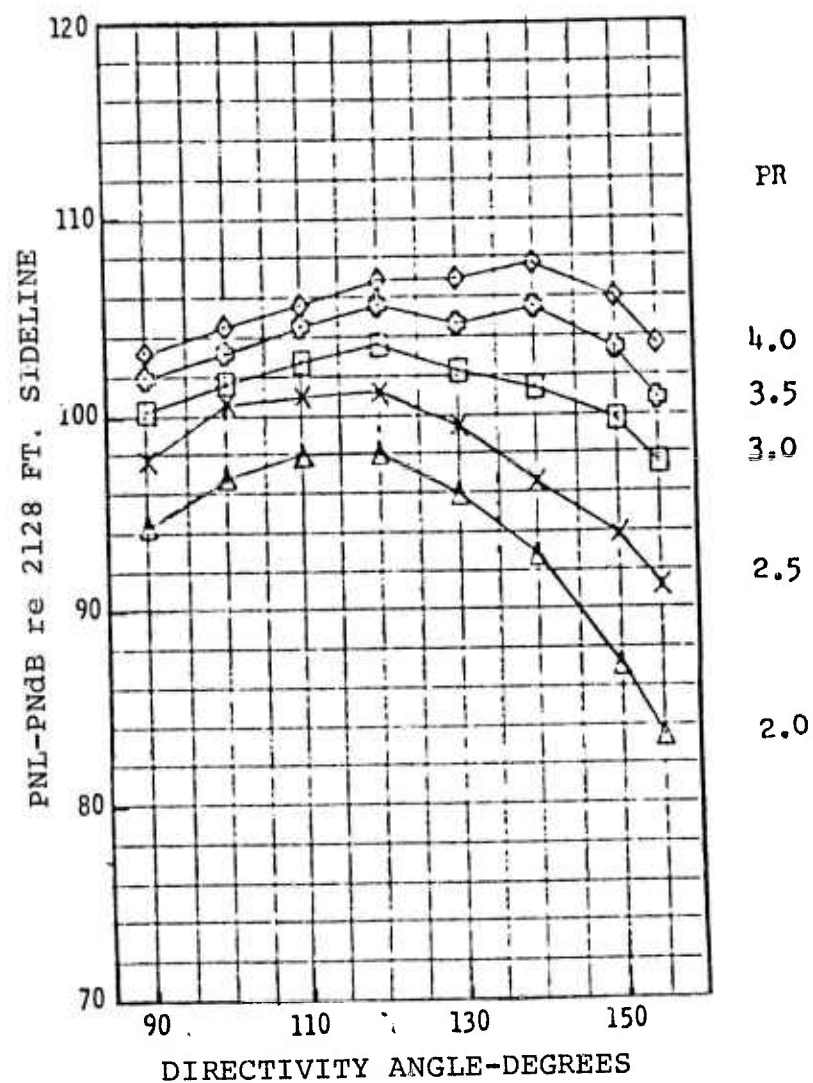


PNL SUPPRESSION-PNdB re: 2128 FT. SIDELINE



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-3.3AR-CPA-ET/RC

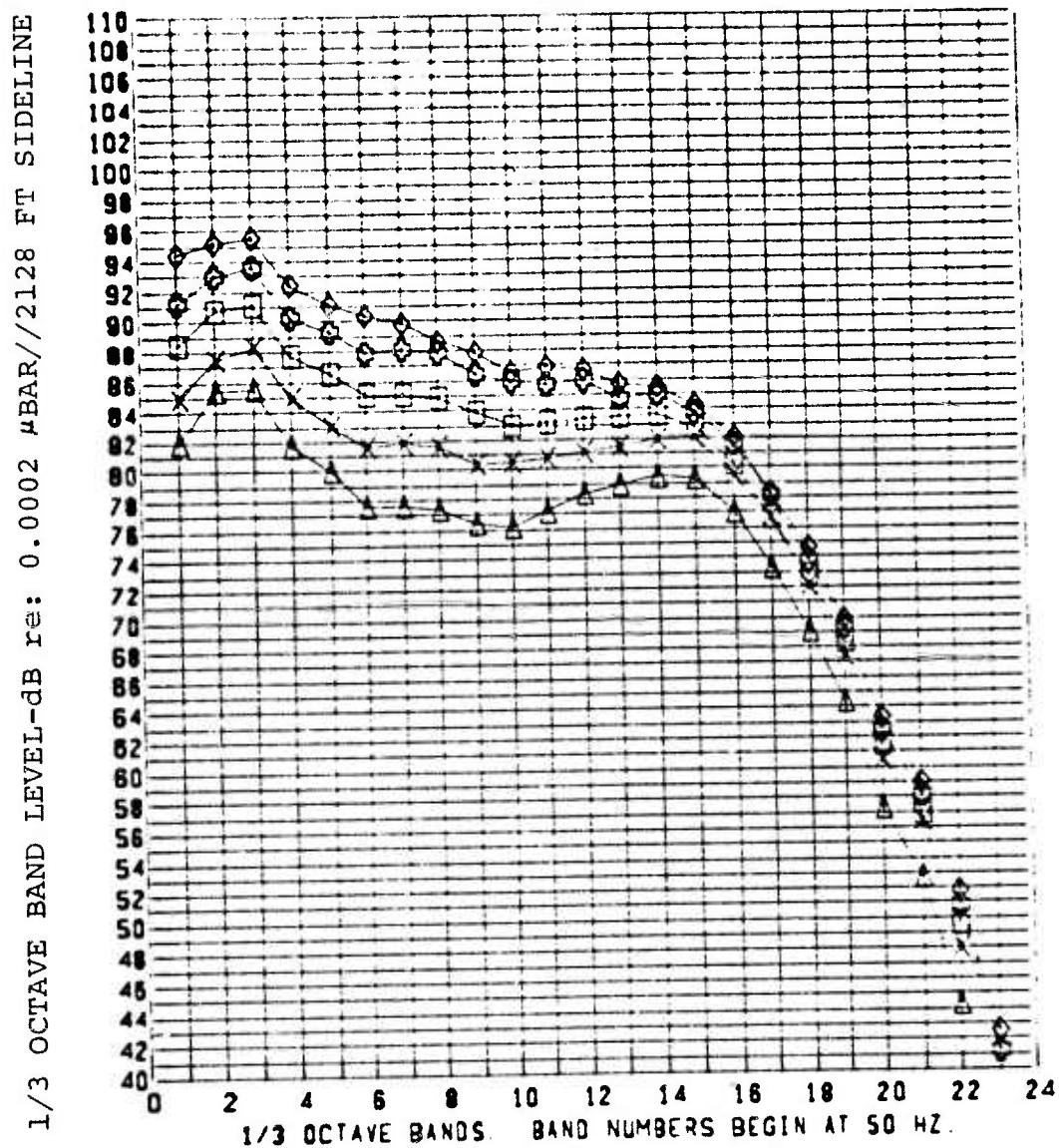


RUN: 006

TT = 1150°F A8 = 6.05 FT²

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

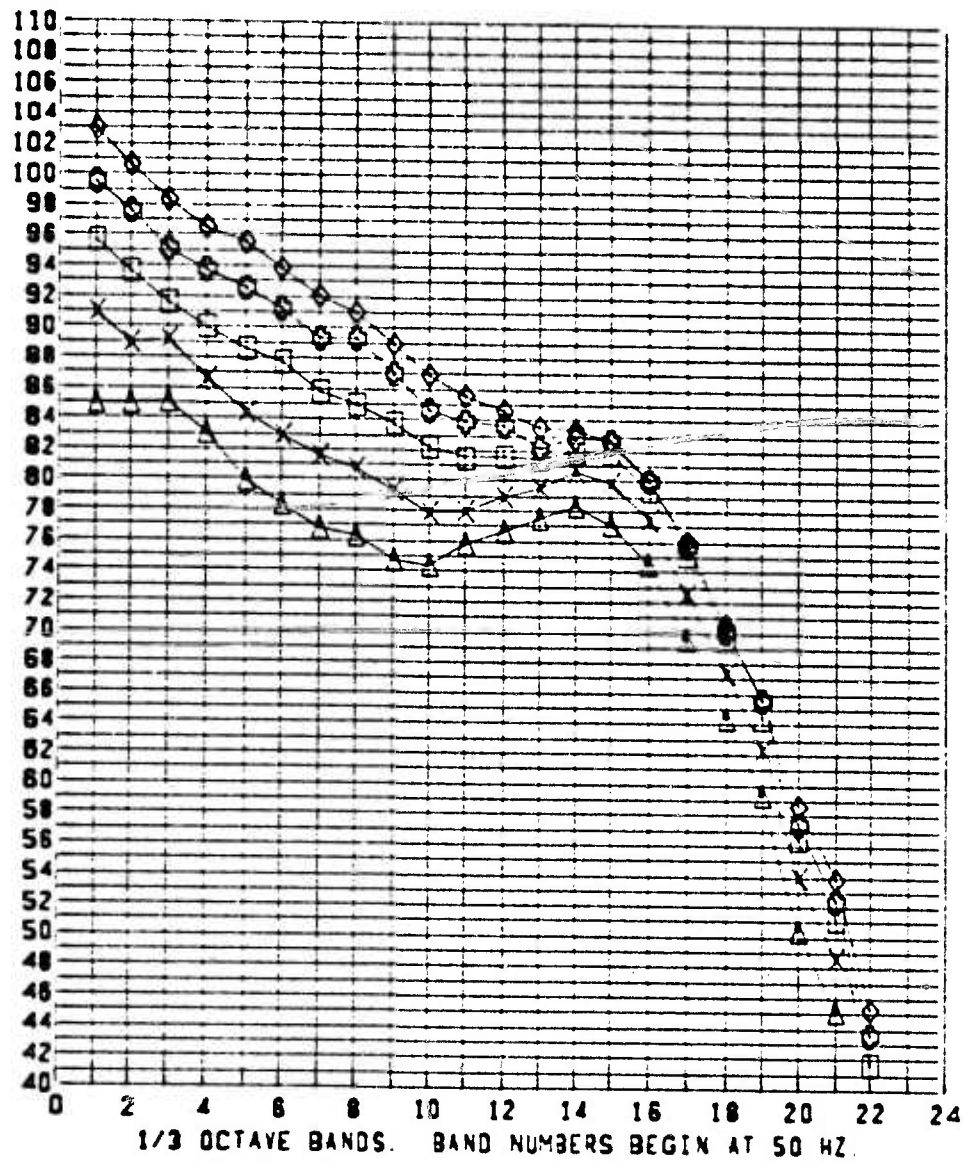


TT = 1150°F A8 = 6.05 FT² RUN: 006
 PR = Δ 2.0, X 2.5, \square 3.0, \oplus 3.5, \diamond 4.0
 NOZZLE: 37T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



TT = 1150°F A8 = 6.05 FT² RUN: 006
 PR = Δ 2.0, \times 2.5, \square 3.0, \oplus 3.5, \diamond 4.0

NOZZLE: 37T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
 re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-3.3AR-CPA-ET/RC
with 3.1AR Ejector

FACILITY: HNTF

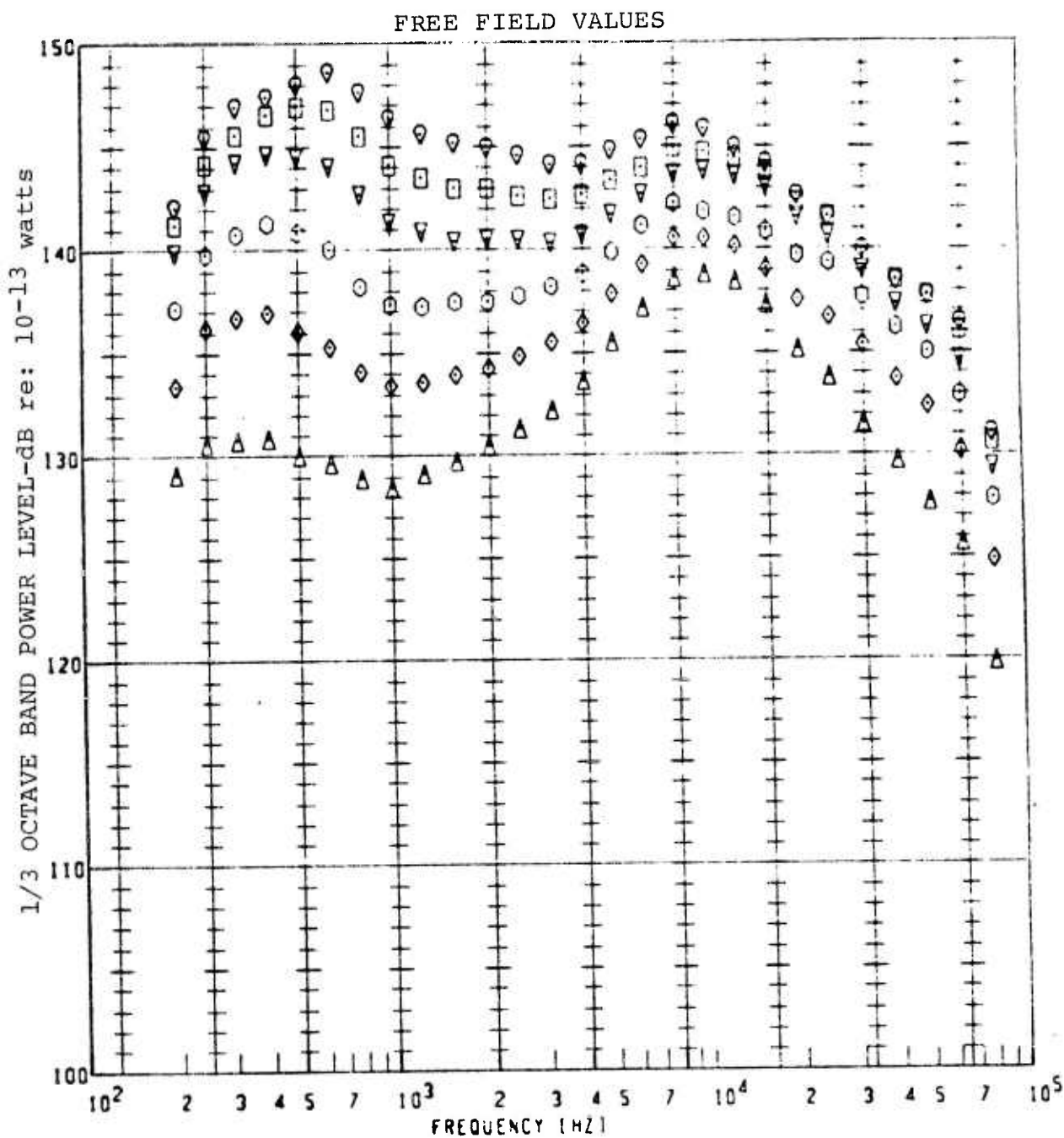
DATE: 8-23-73

T_{AMB} = 54.5°F **R.H.** = 70%

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
16	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

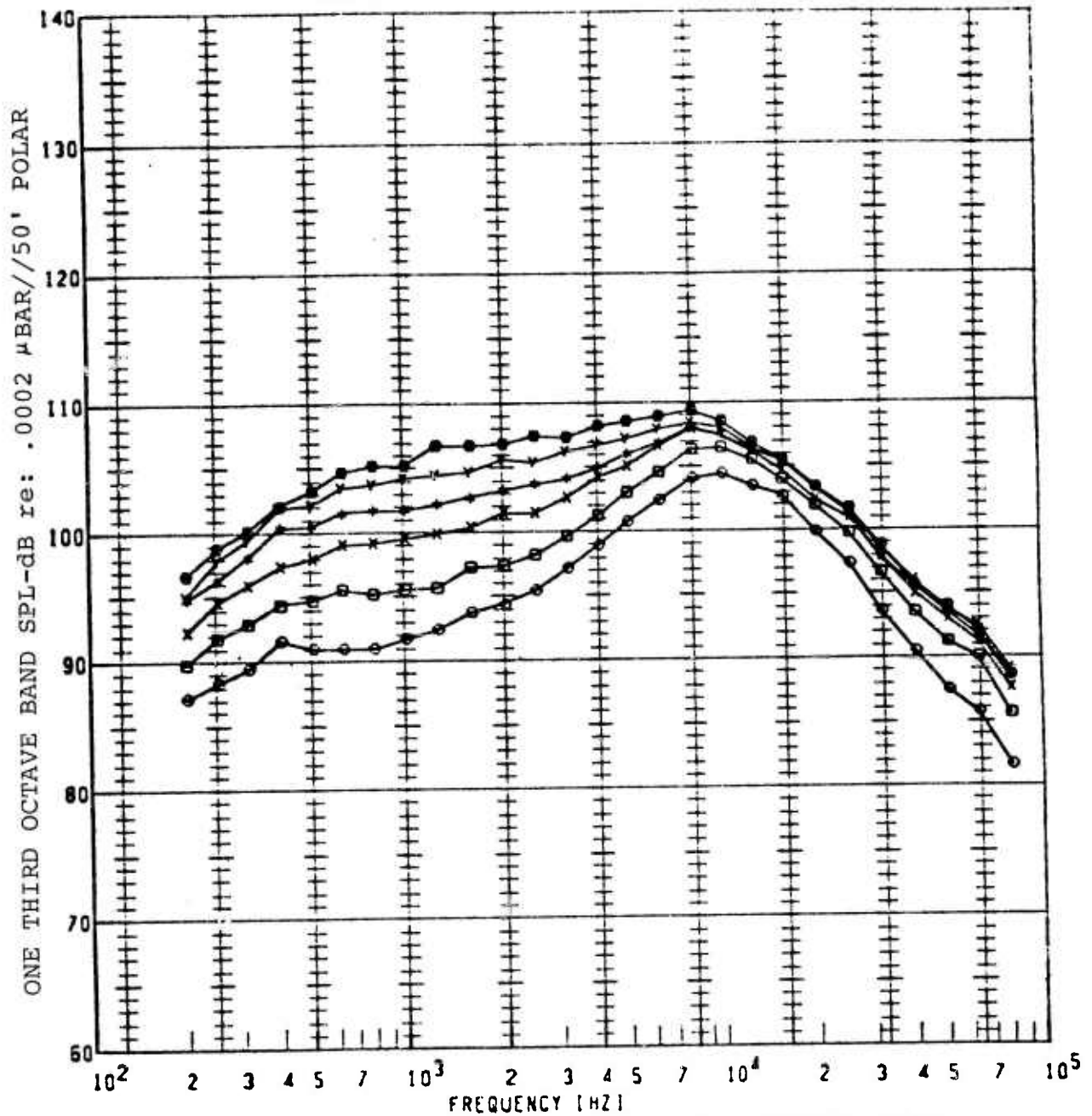


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	16	2.00	1150°F
◇	16	2.50	1150
○	16	3.00	1150
▽	16	3.40	1150
□	16	3.70	1150
◊	16	4.00	1150

37T-3.3AR-CPA-ET/RC
WITH 3.1AR EJECTOR

JET NOISE POWER SPECTRA

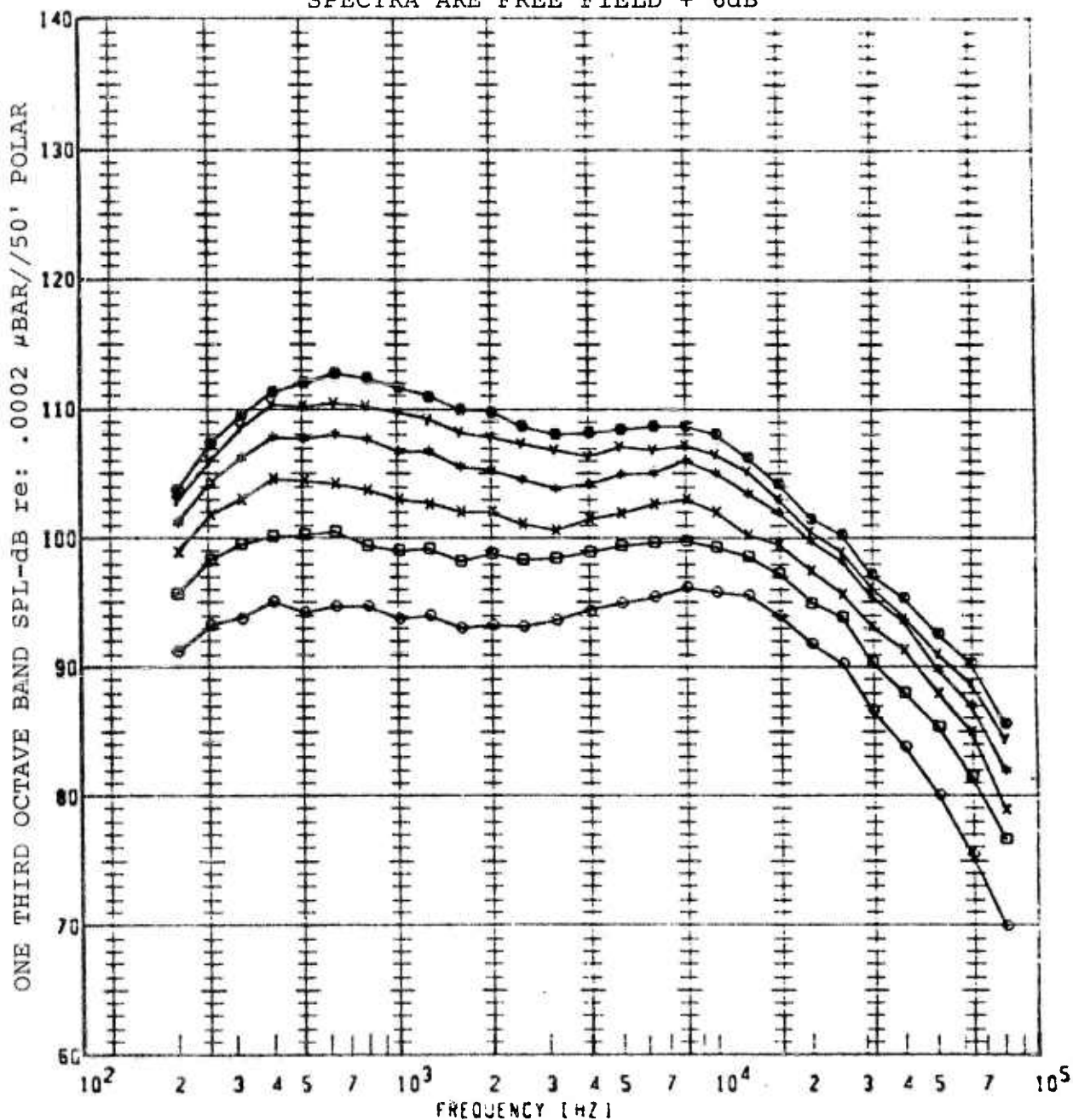
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
○	16G	1150°F	2.000	110°	50FP	112.4
□	16G	1150	2.500		50FP	114.7
x	16G	1150	3.000		50FP	116.5
*	16G	1150	3.400		50FP	117.4
△	16G	1150	3.700		50FP	118.6
●	16G	1150	4.000		50FP	119.6

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

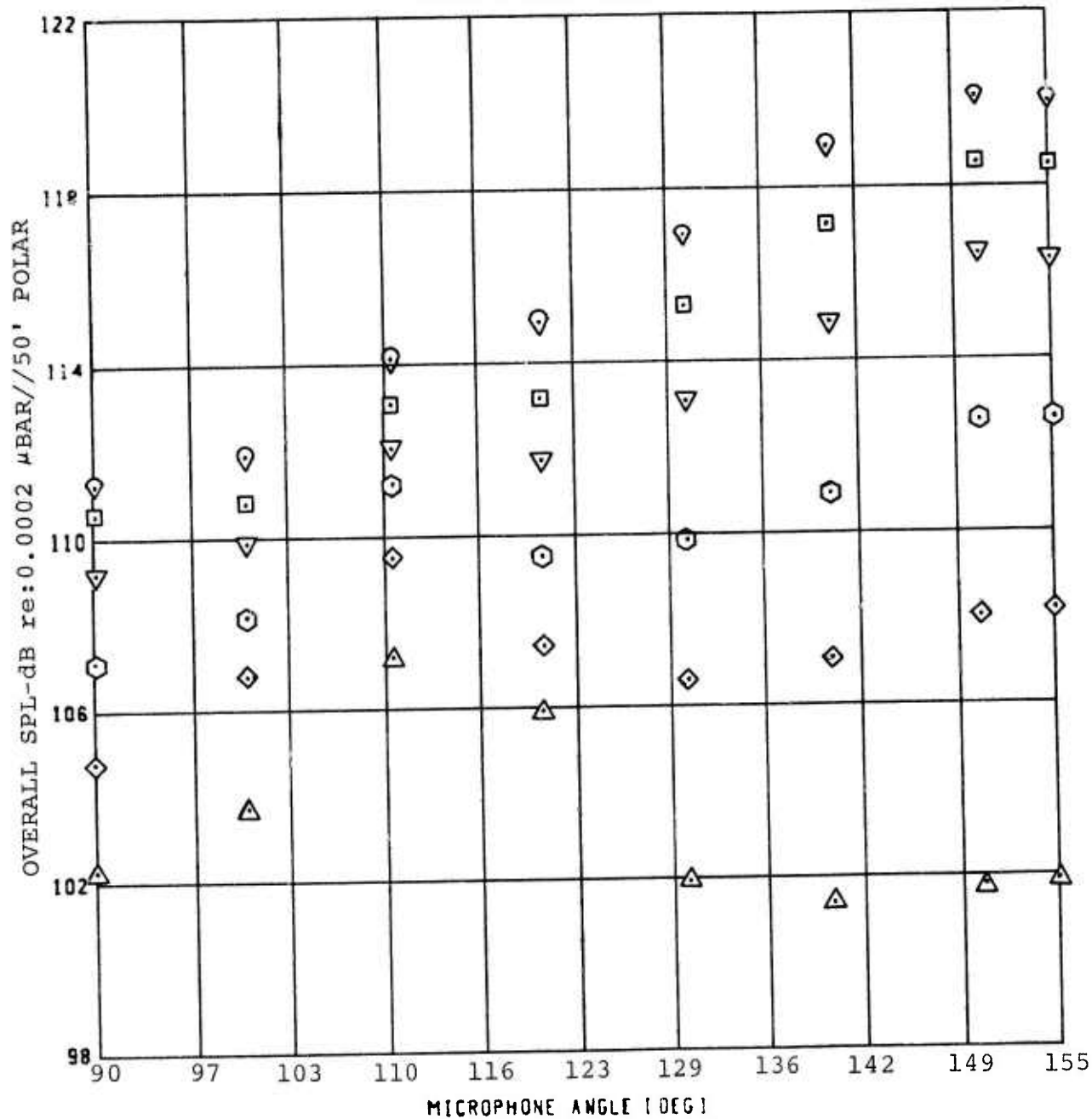
SPECTRA ARE FREE FIELD + 6dB



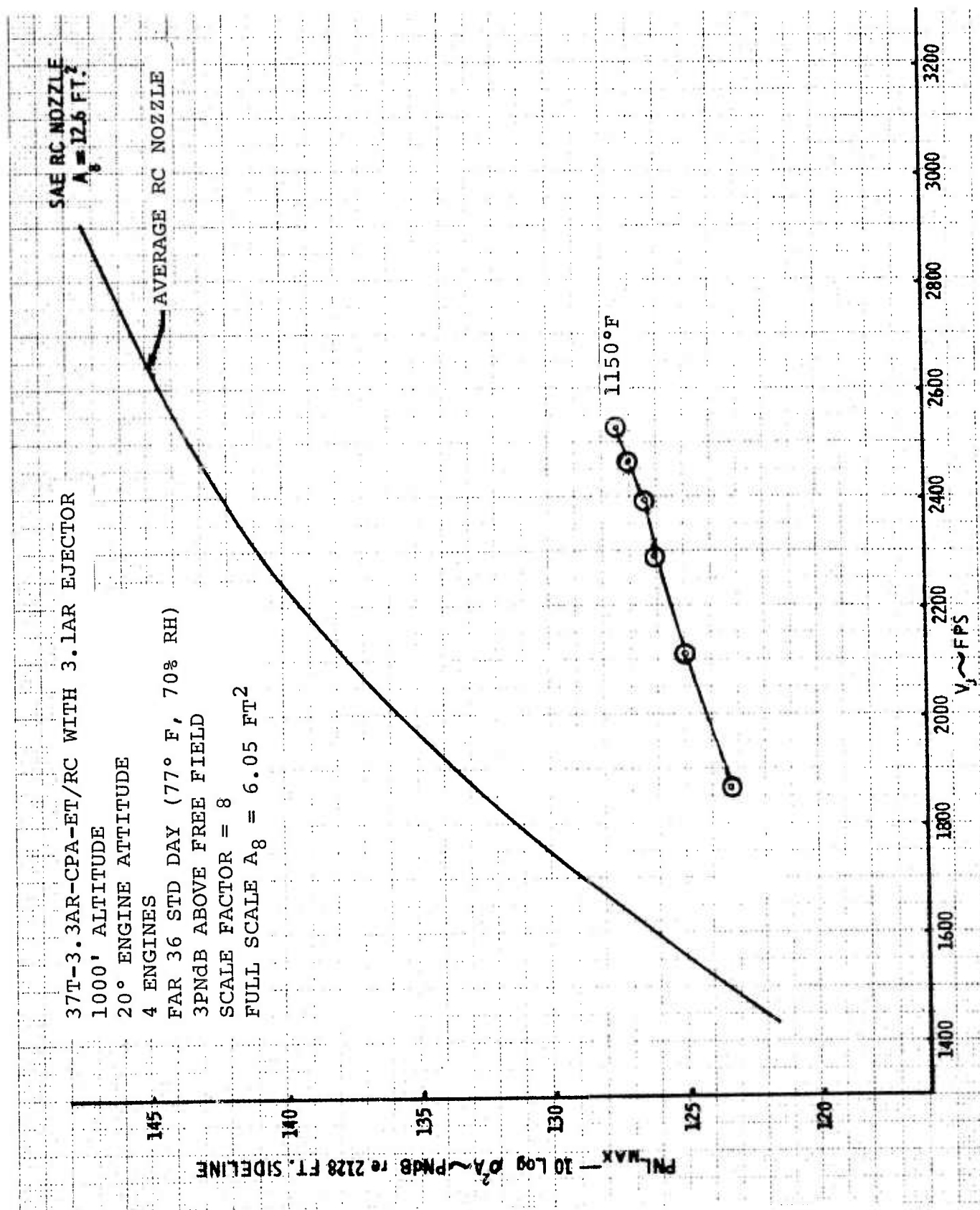
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	CASPL (DB)
○	16G	1150°F	2.000	130°F ↓	SOFP	107.6
□	16G	1150	2.500		SOFP	112.2
x	16G	1150	3.000		SOFP	115.6
*	16G	1150	3.400		SOFP	118.8
y	16G	1150	3.700		SOFP	121.1
●	16G	1150	4.000		SOFP	122.7

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

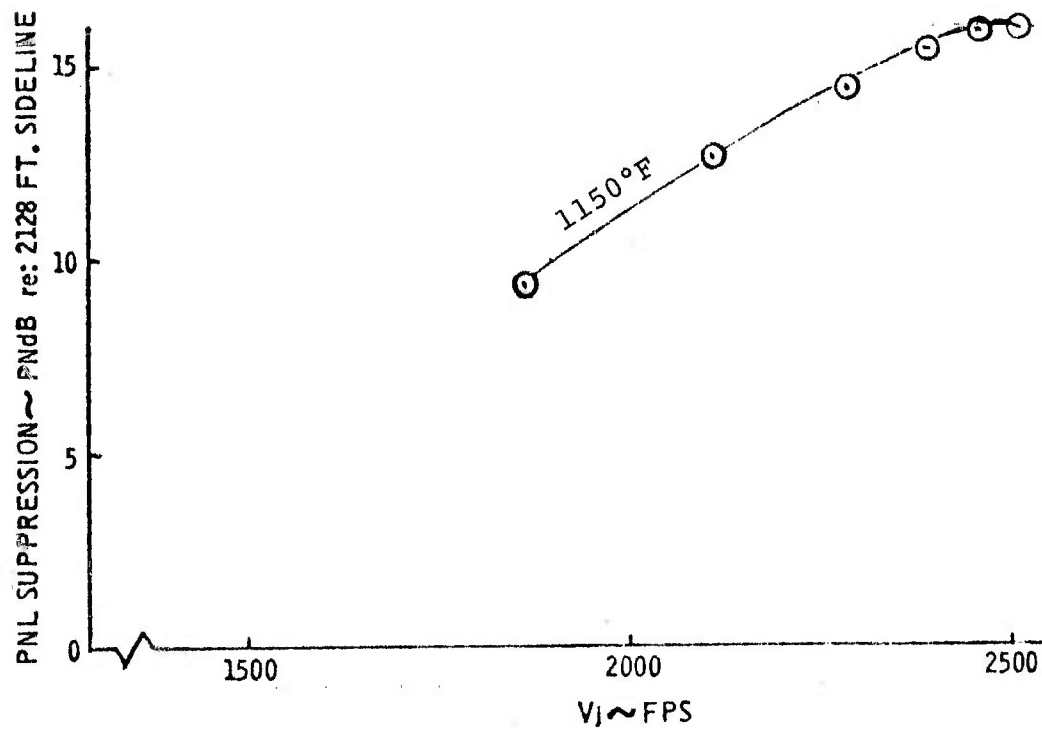
FREE FIELD VALUES



OASPL BEAM PATTERNS

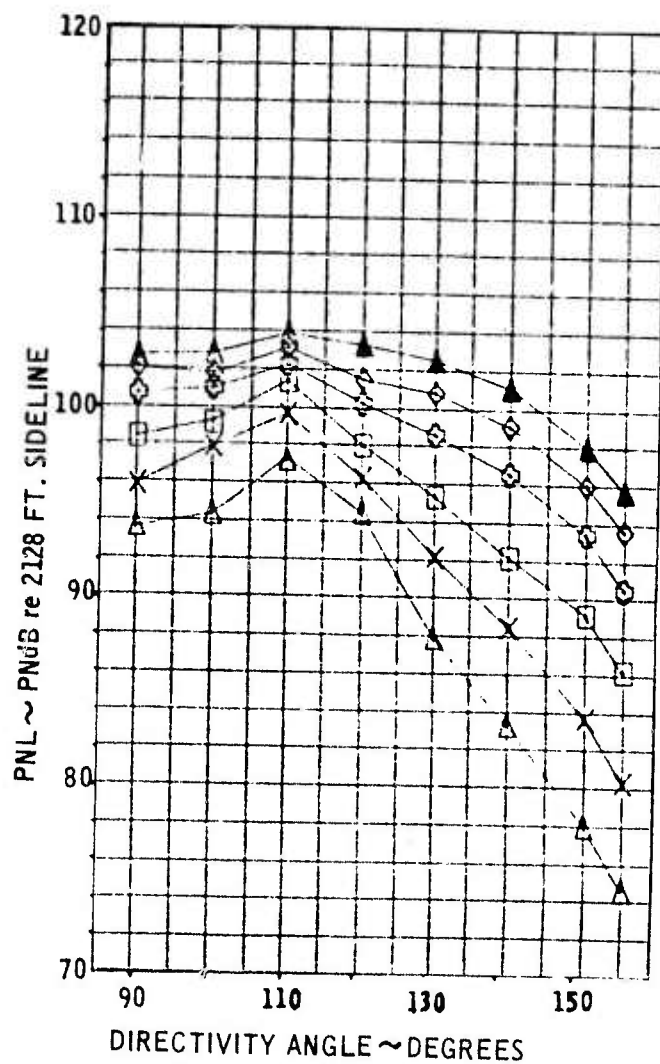


37T-3.3AR-CPA-ET/RC WITH 3.1AR EJECTOR



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-3.3AR-CPA-ET/RC
WITH 3.1 AR EJECTOR

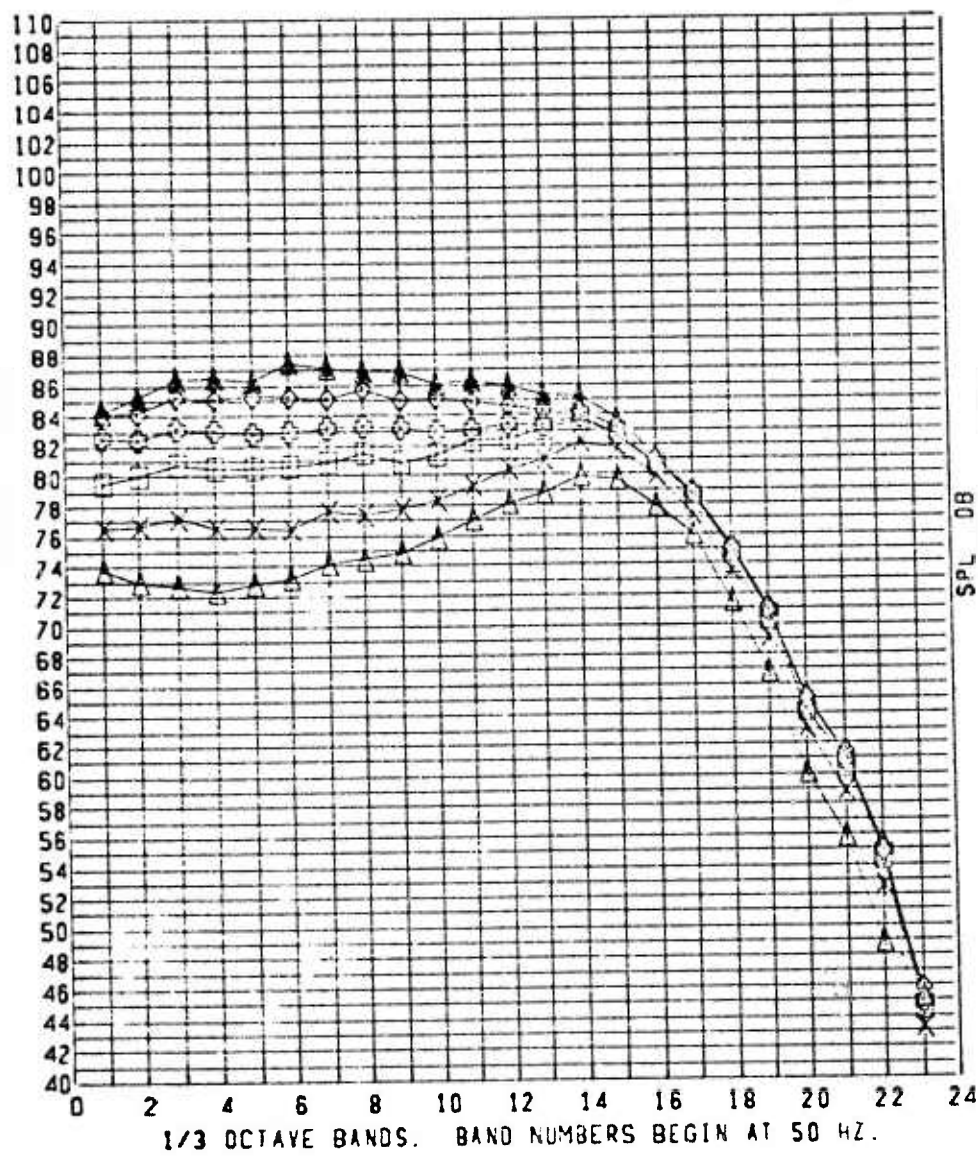


Tt = 1150°F A8 = 6.05 FT² RUN: 16
PR = Δ 2.0, X 2.5, □ 3.0, ⊕ 3.4, ◇ 3.7 ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

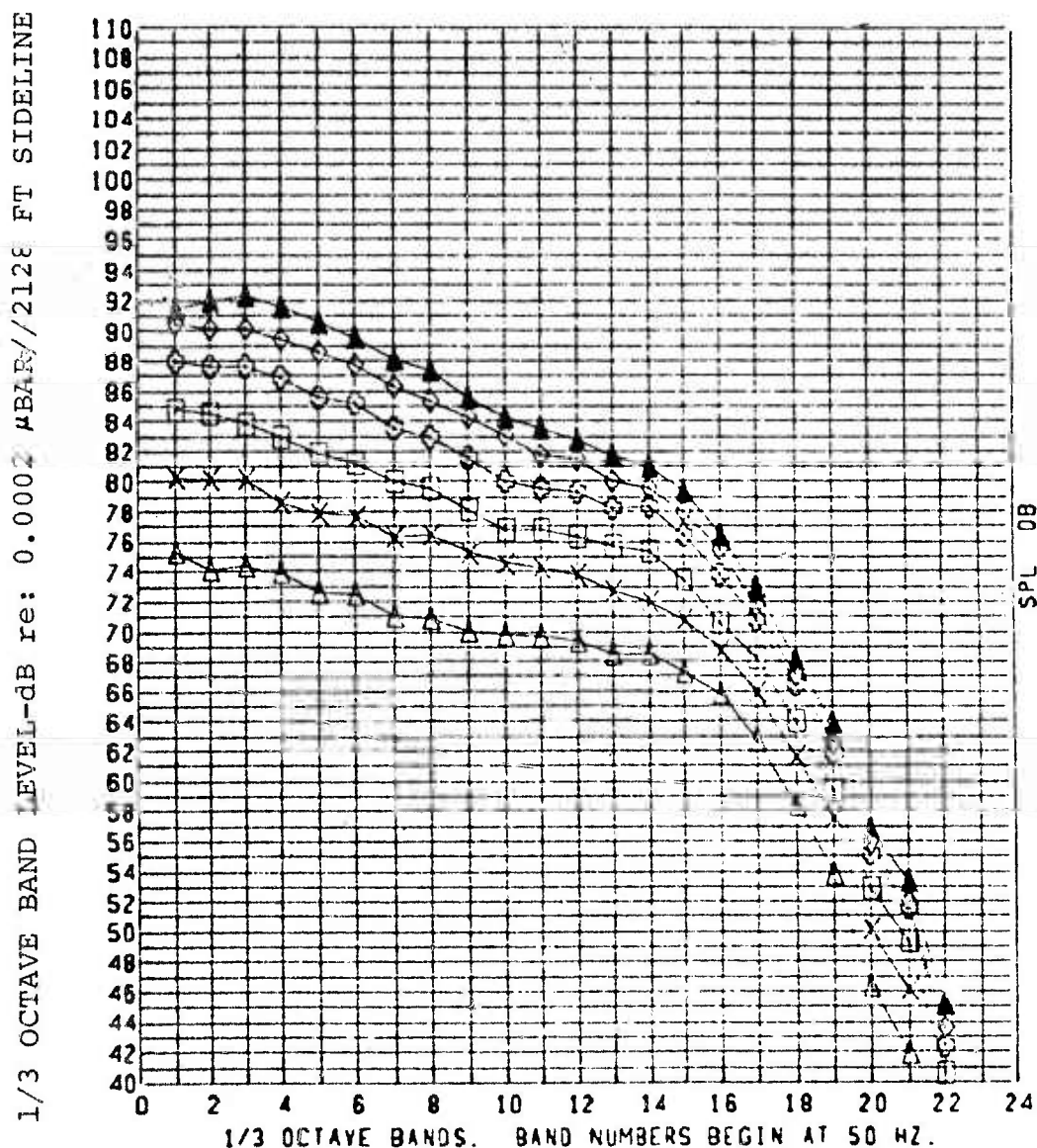
1/3 OCTAVE BAND LEVEL-dB re: 0.0002 #BAR//2128 FT SIDELINE



TT = 1150°F A8 = 6.05 FT² RUN: 16
 PR = Δ 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7, \blacktriangle 4.0

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



$T_t = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 16

PR = Δ 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7, \blacktriangle

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE 130°
 re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 377-3.3AR-CPA-ET/RC
WITH 3.1AR EJECTOR BELLMOUTH, L/D=2

FACILITY: WALL ISOLATION FACILITY

DATE: January 4, 1974

P_{AMB} = 29.83 in Hg **T_{AMB}** = 30°F **R.H.** = 56%

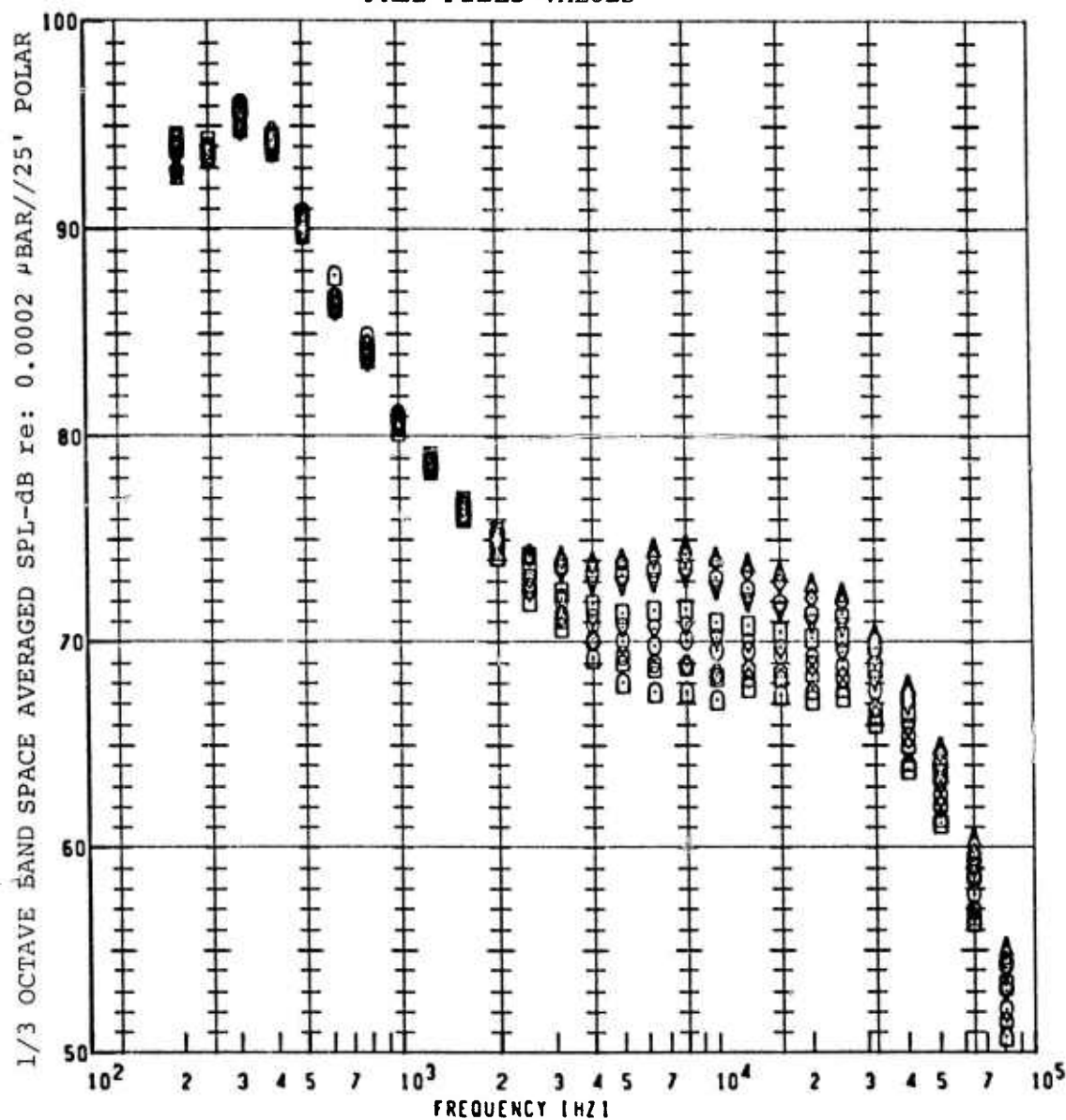
NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
377	0.0 x/D*	9.4 in.	*x/D is relative	
380	0.25	9.6	to ejector exit	
383	0.50	9.8	plane	
386	0.75	10.0		
389	1.00	10.4		
392	1.25	10.6		
395	1.50	10.8		
398	1.75	11.2		
401	2.0	13.6		
404	2.5	13.0		
407	3.0	13.4		
410	3.5	14.4		
413	4.0	15.4		
416	5.0	14.4		
419	6.0	15.6		
422	7.0	16.4		
425	8.0	17.8		
428	10.0	19.8		
	12.0			
431	14.0	22.0		
434		24.0		

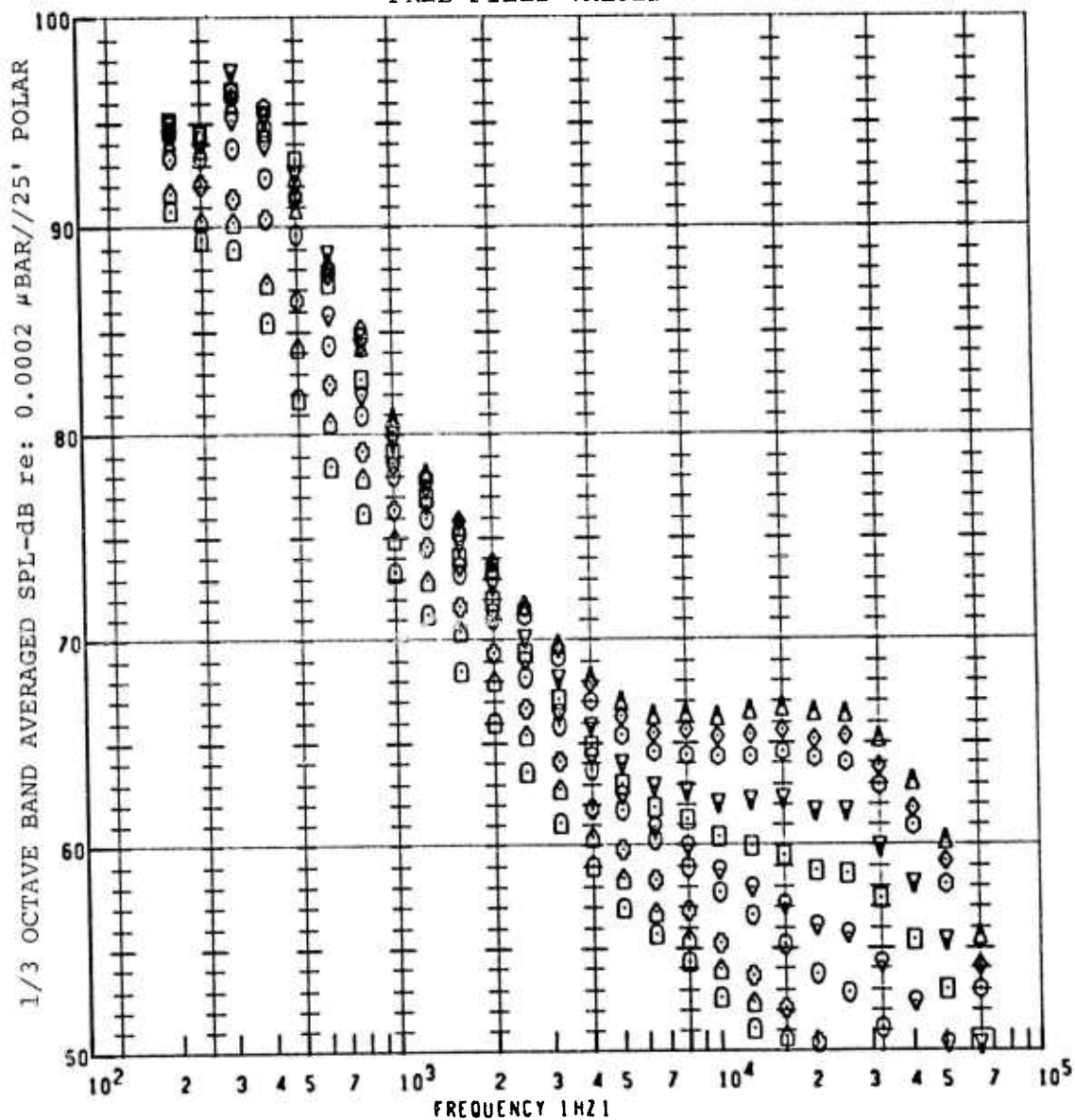
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

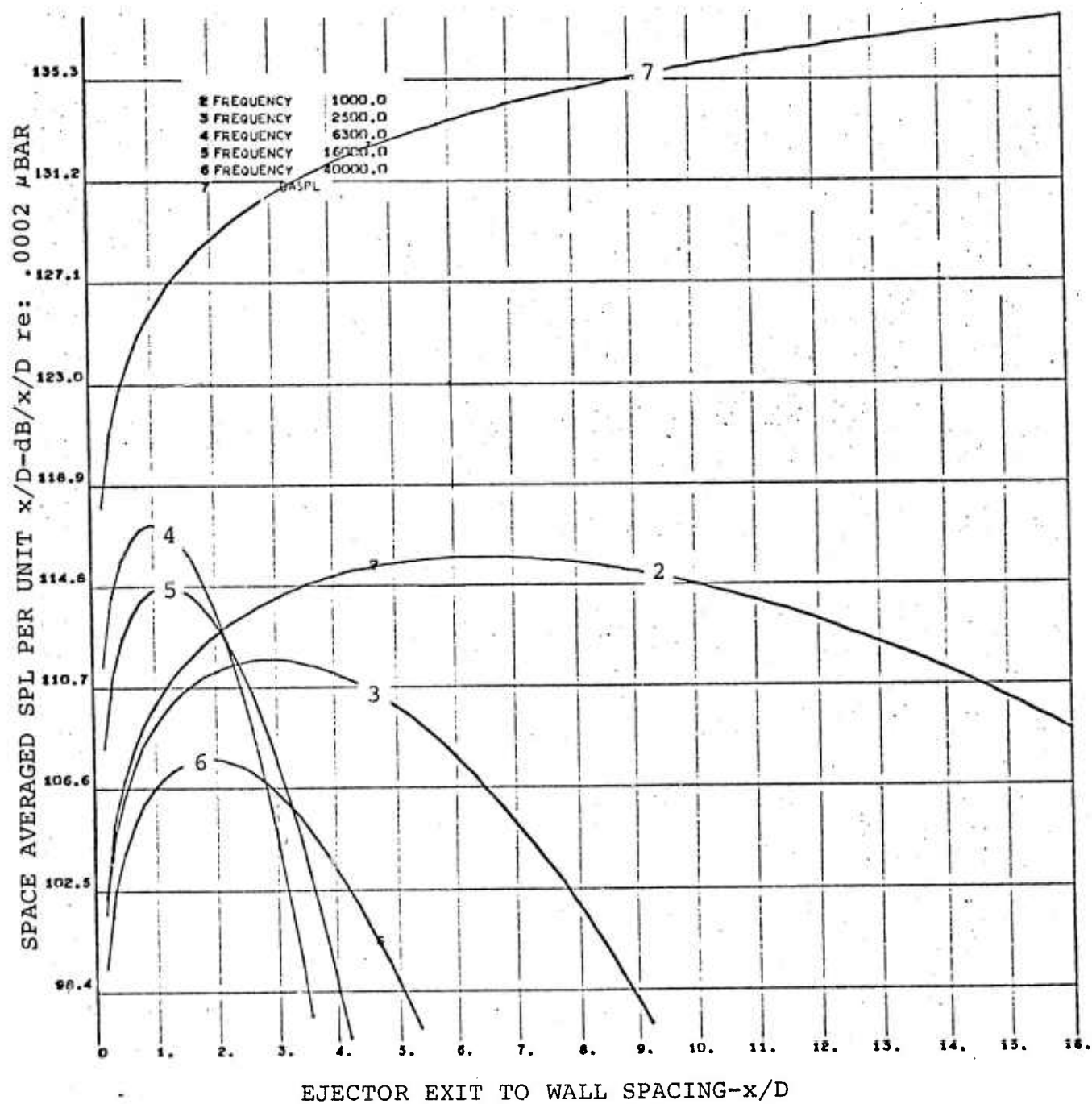


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP	AXIAL LOCATION, x/D
▲	377	3.00	1150°F	0
◊	380	3.00	1150	.25
◊	383	3.00	1150	.50
▼	386	3.00	1150	.75
◻	389	3.00	1150	1.0
◊	392	3.00	1150	1.2
○	395	3.00	1150	1.5
◊	398	3.00	1150	1.7
△	401	3.00	1150	2.0
◻	404	3.00	1150	2.5

FREE FIELD VALUES



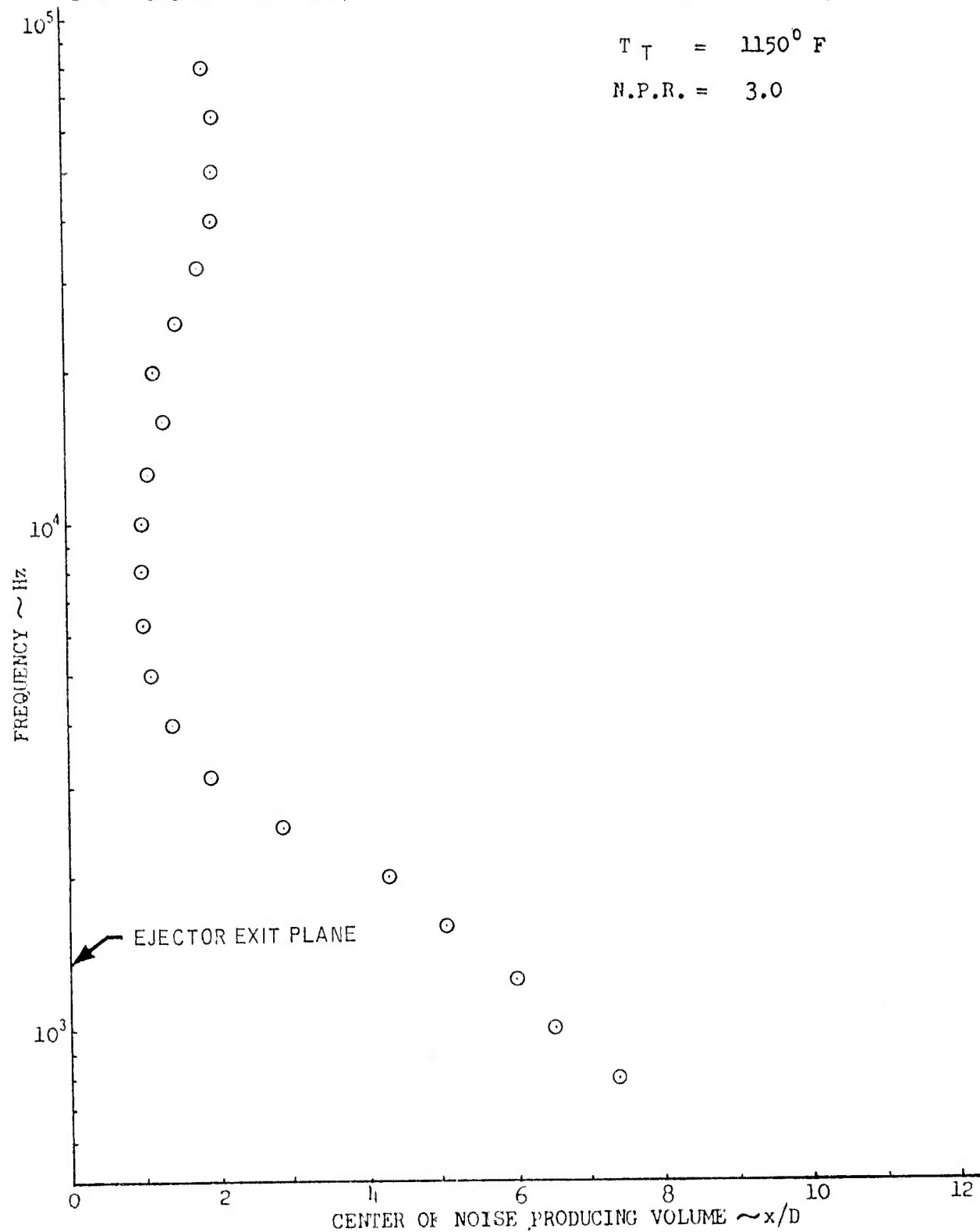
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	407	3.00	1150°F
◇	410	3.00	1150
○	413	3.00	1150
▽	416	3.00	1150
□	419	3.00	1150
◊	422	3.00	1150
○	425	3.00	1150
◇	428	3.00	1150
△	431	3.00	1150
□	434	3.00	1150

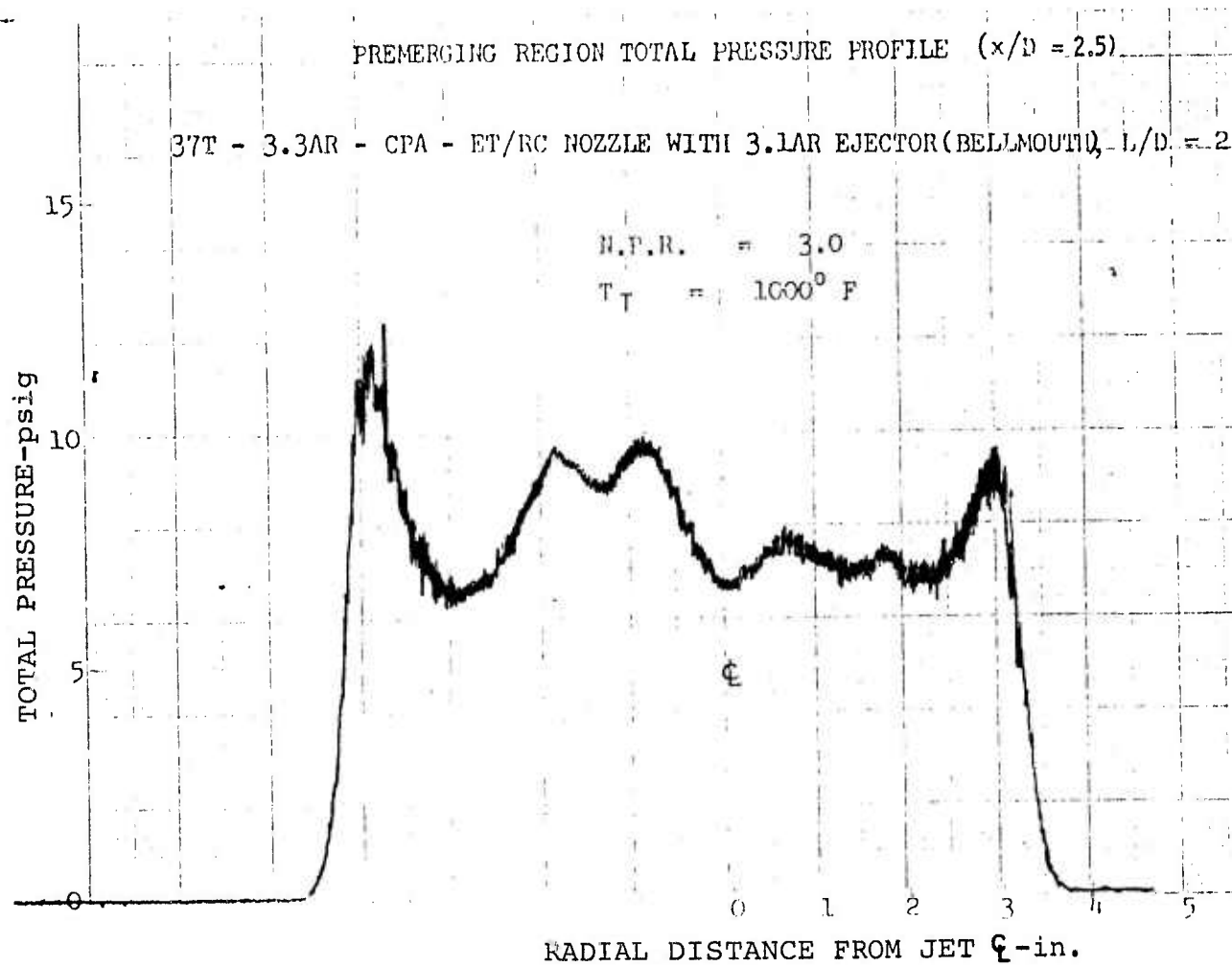


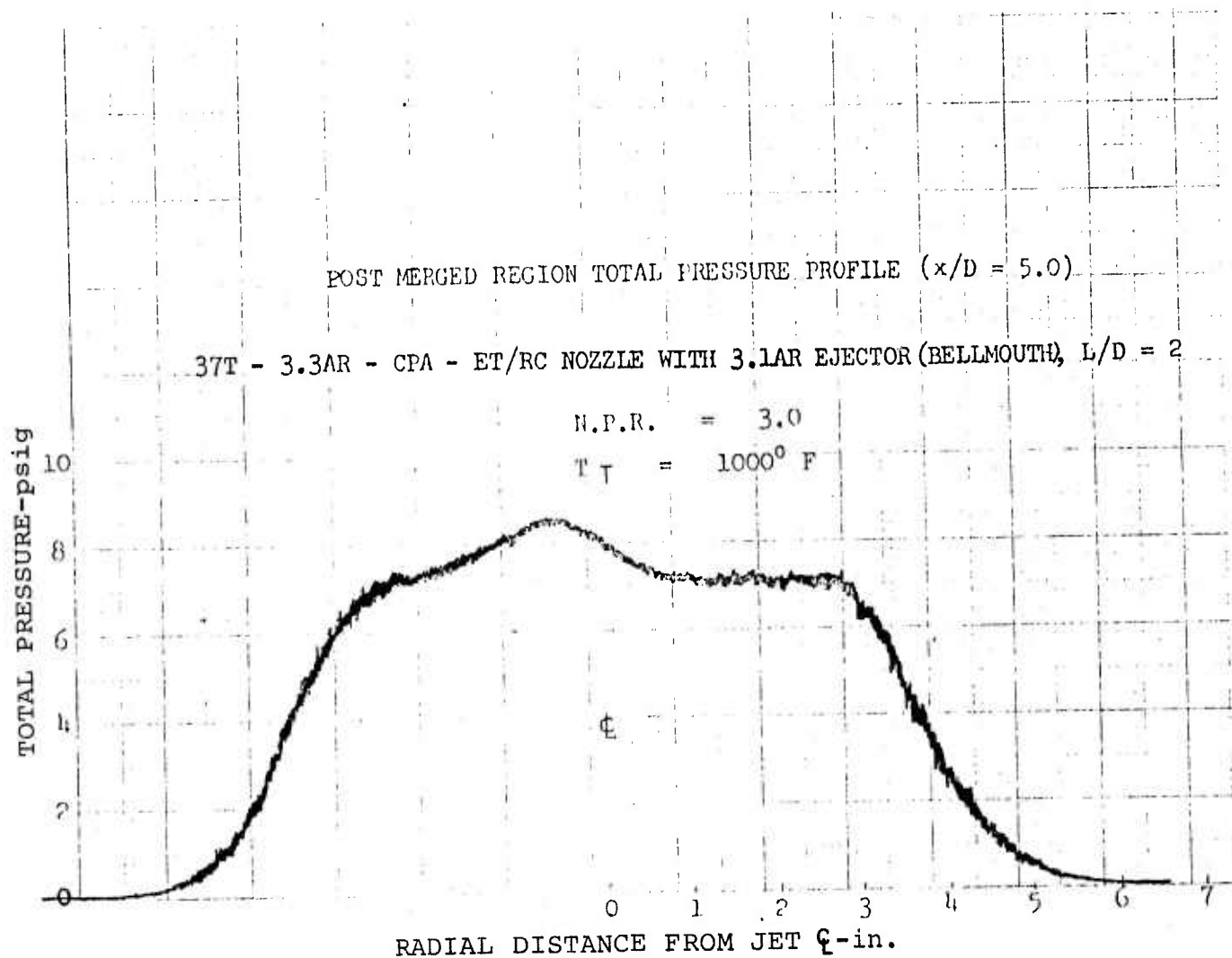
37T - 3.3AR - CPA - ET/RC NOZZLE WITH 3.1AR EJECTOR BELLMOUTH, L/D = 2

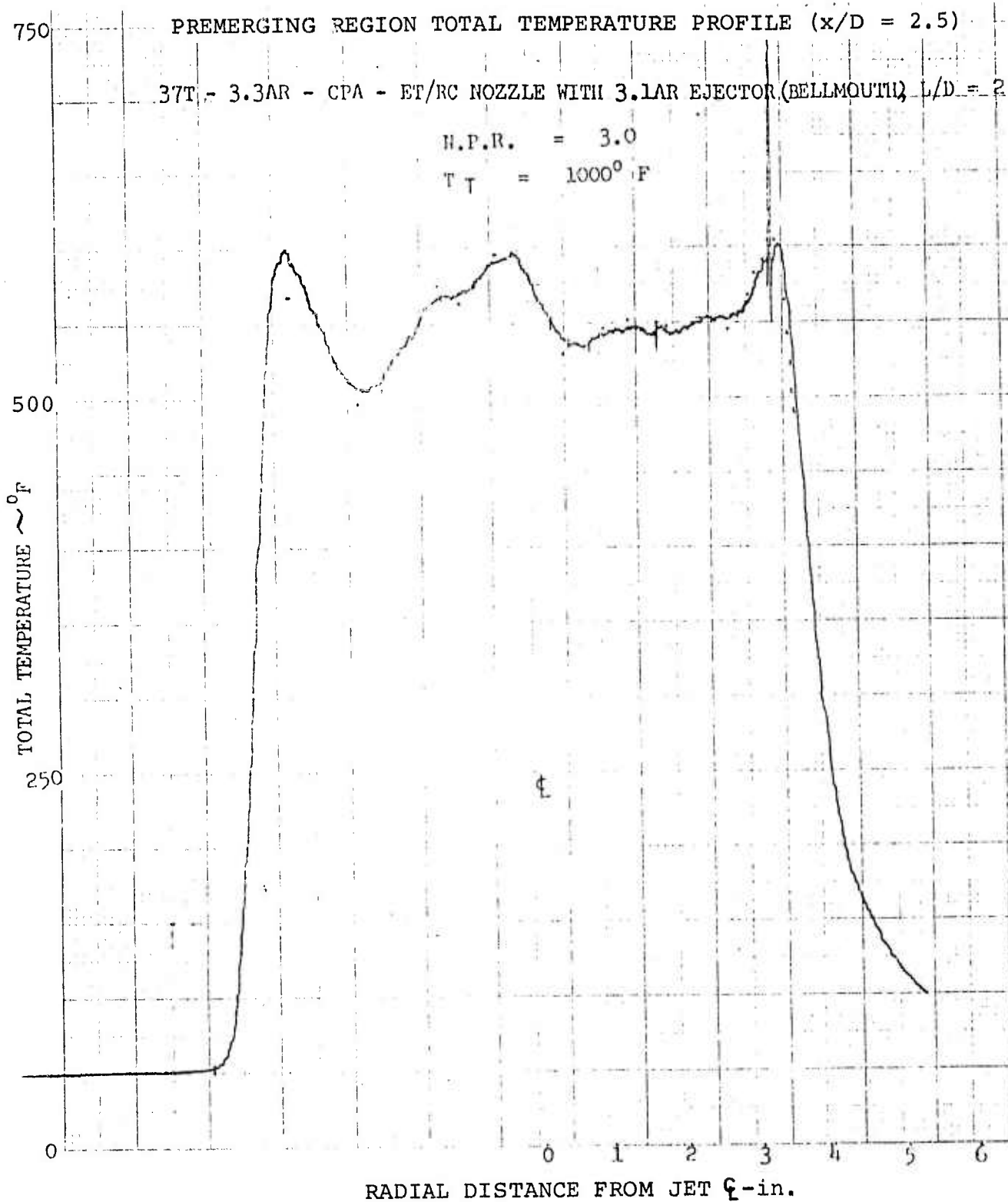
$T_T = 1150^\circ \text{F}$

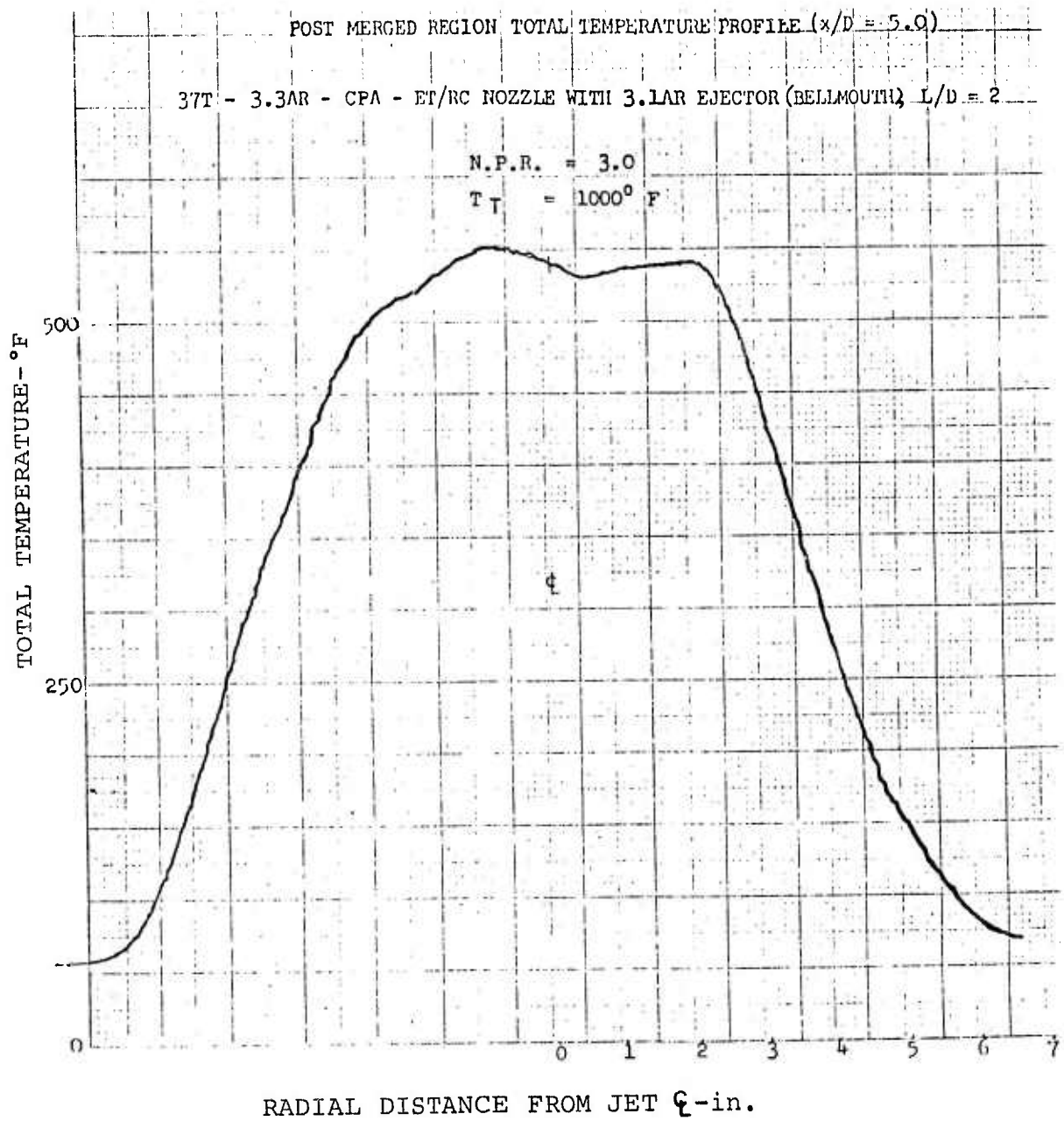
N.P.R. = 3.0



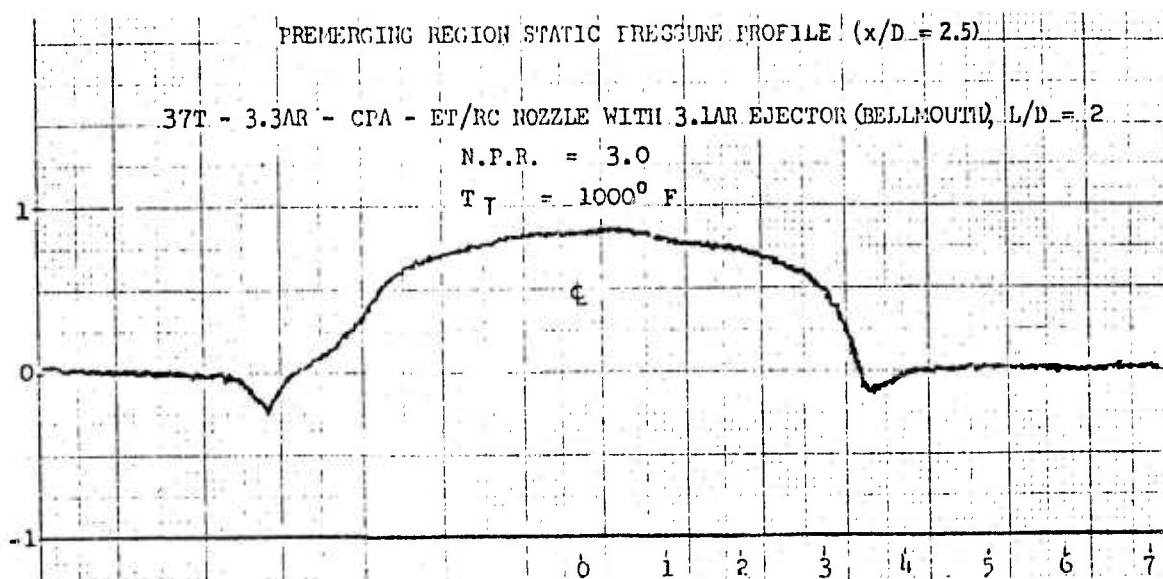




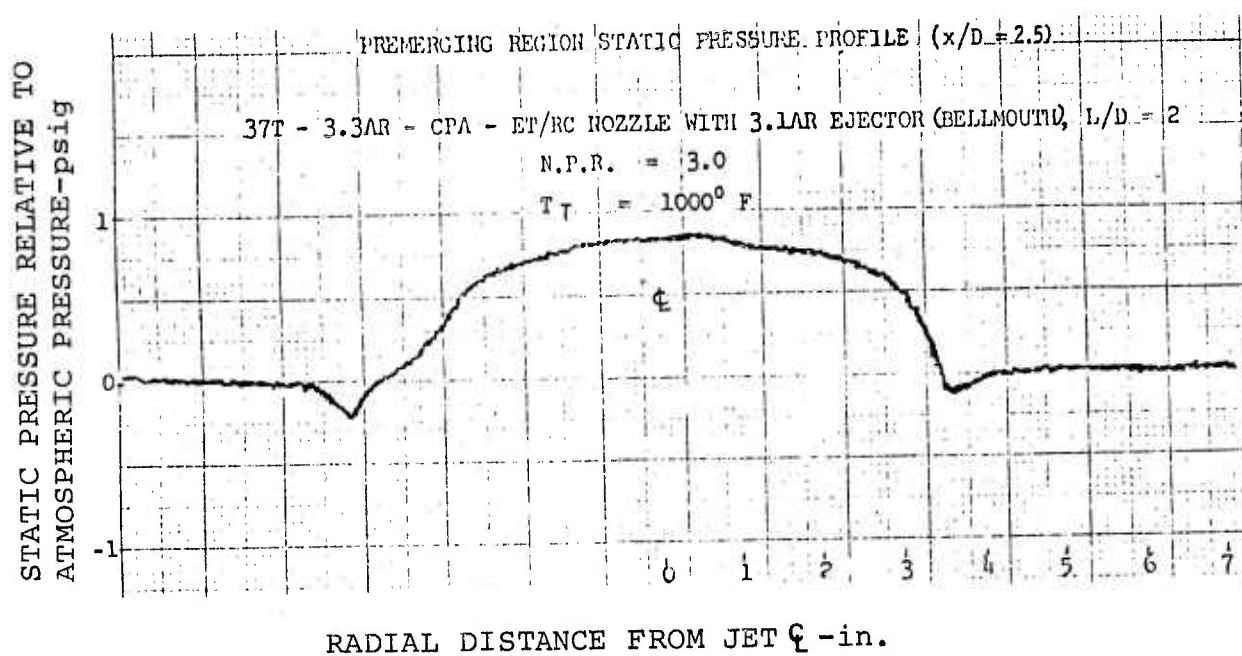




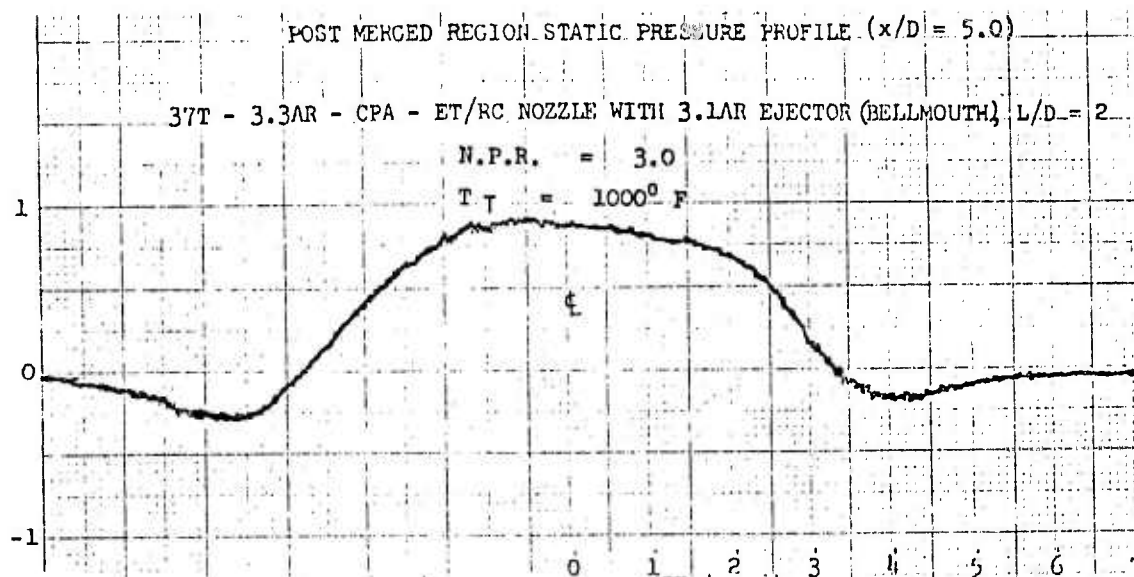
STATIC PRESSURE RELATIVE TO
ATMOSPHERIC PRESSURE-psig



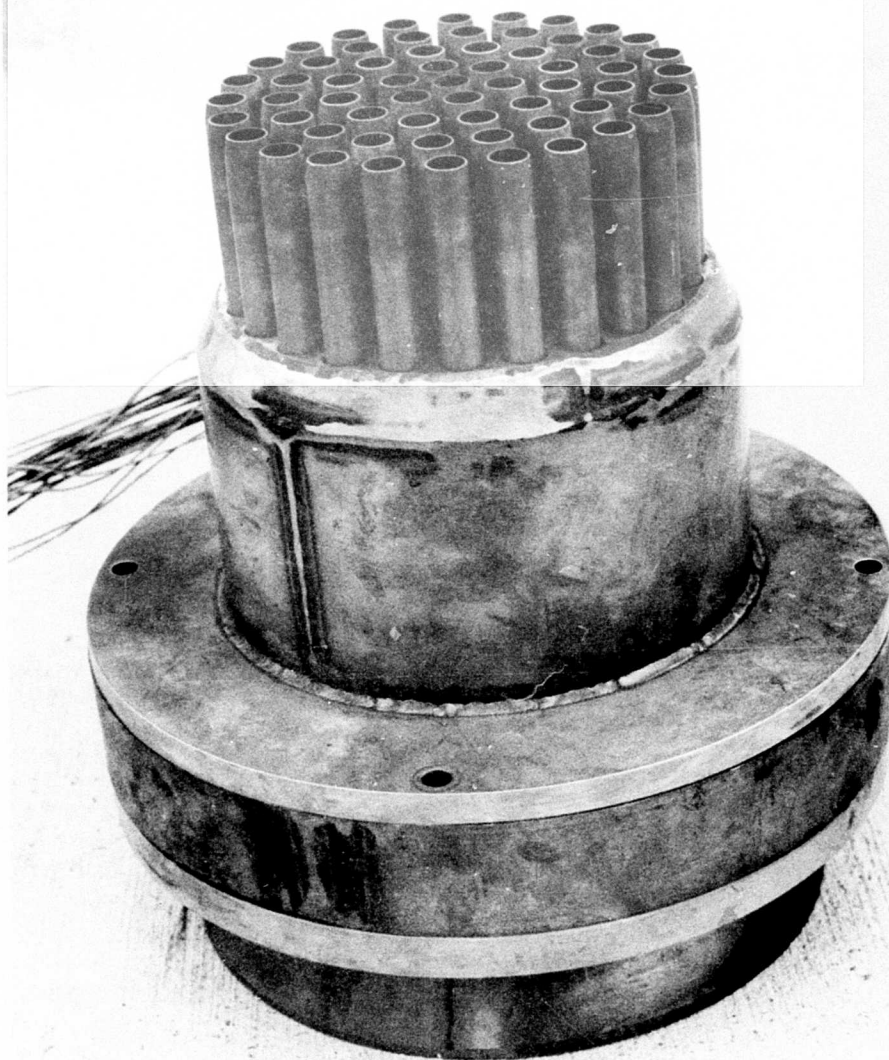
RADIAL DISTANCE FROM JET ξ -in.



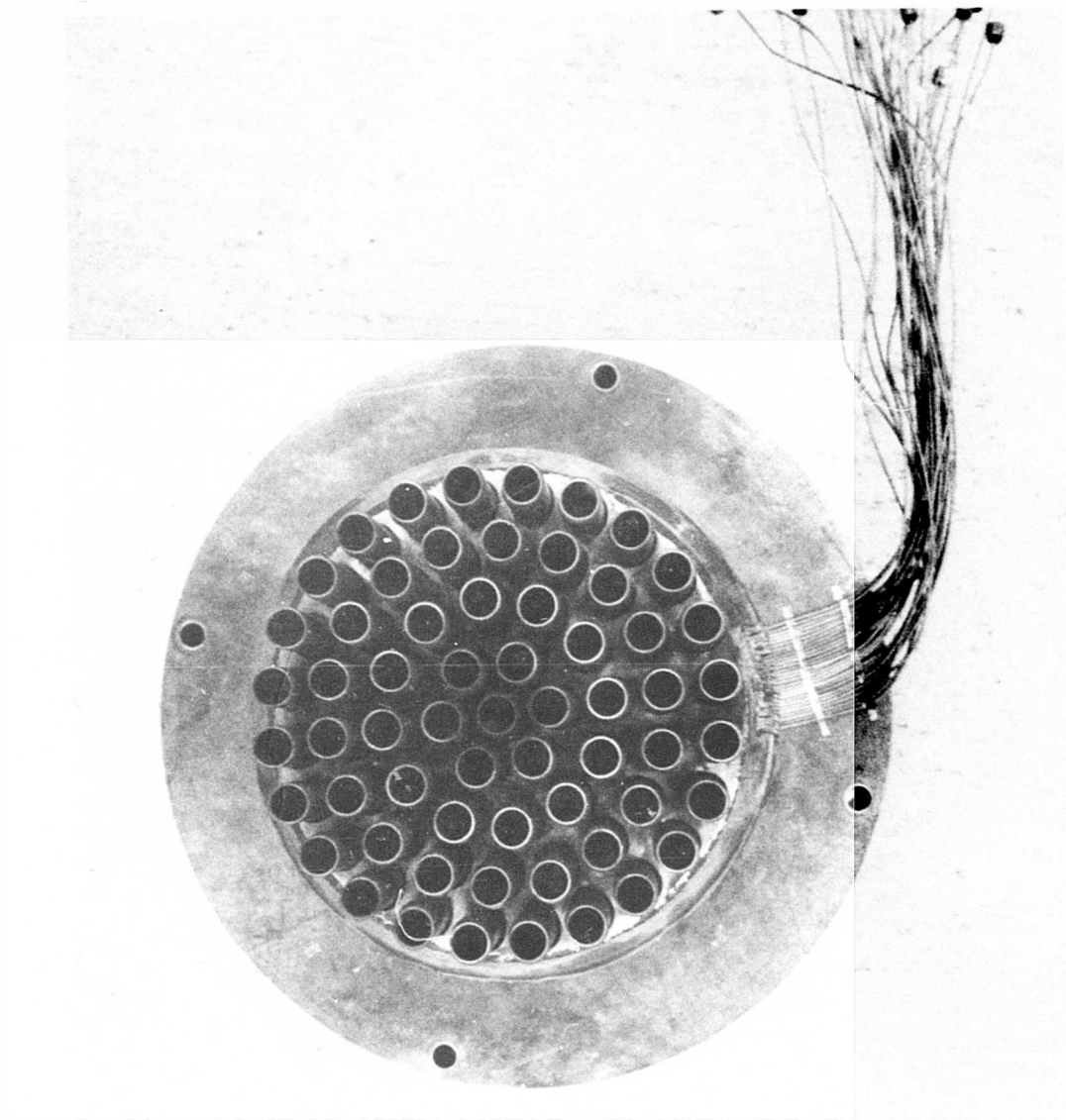
STATIC PRESSURE RELATIVE TO
ATMOSPHERIC PRESSURE-psig



RADIAL DISTANCE FROM JET r -in.



61T-3.3AR-CPA-ET/RC NOZZLE



61T-3.3AR-CPA-ET/RC NOZZLE

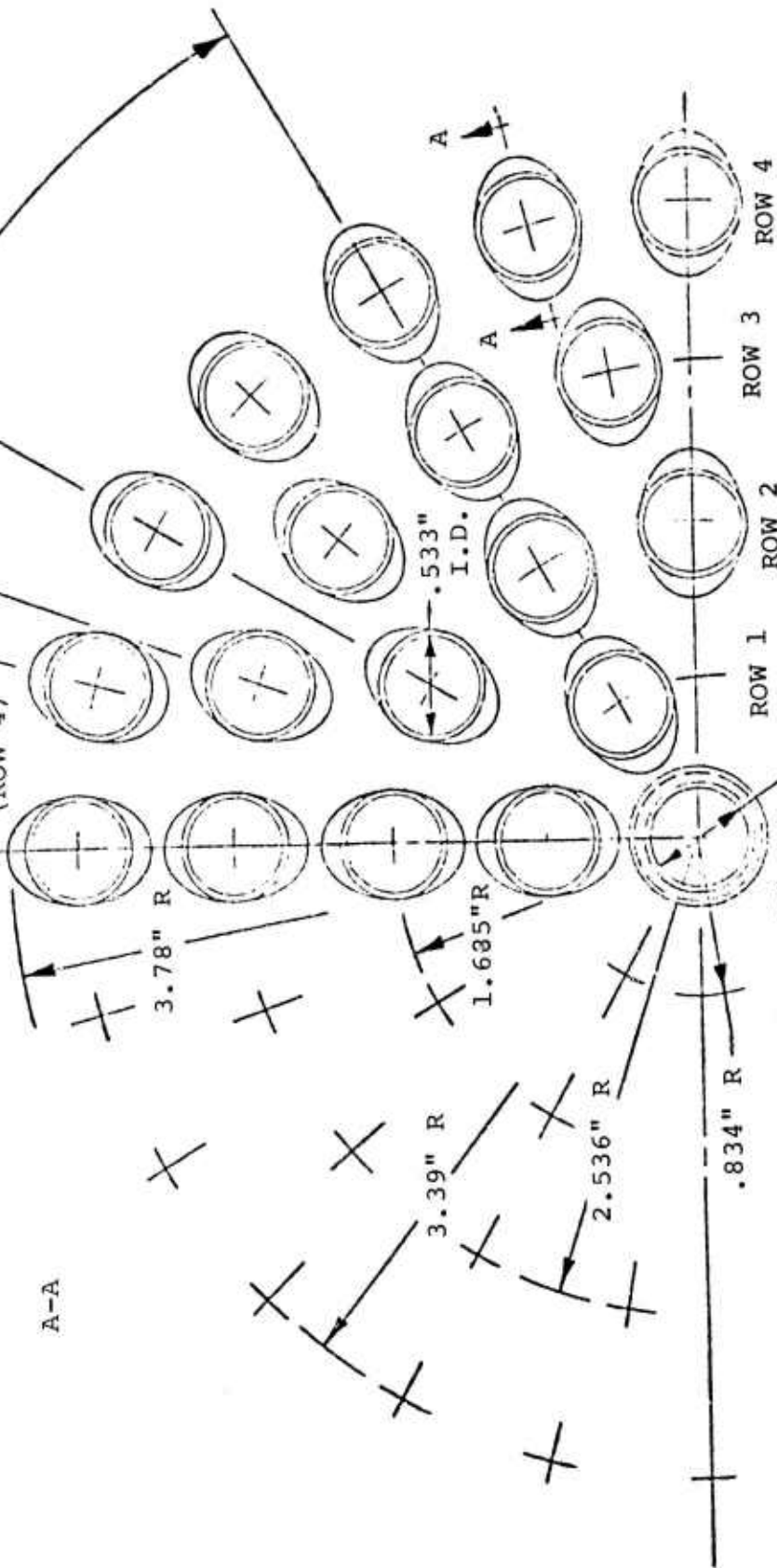
12° NOM.



(TUBE EXIT PLANE TO
TUBE HOLDER PLATE)

MAT'L-.035 WALL,
NOTE: CENTER TUBE IS A .75" DIA.
TUBE WITH A 12° NOM. CONVERGENCE
TO .533" DIA. EXIT
61T-3.3AR-CPA-ET/RC
 $A_g = 13.6 \text{ IN.}^2$

30° TYP.
20° TYP. (ROW 2)
15° TYP. (ROW 4)
60° TYP. (ROW 1)



61 TUBE - AREA RATIO 3.3 ELLIPTICAL RUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 61T-3.3AR-CPA-ET/RC

FACILITY: HNTF

DATE: 1-31-73

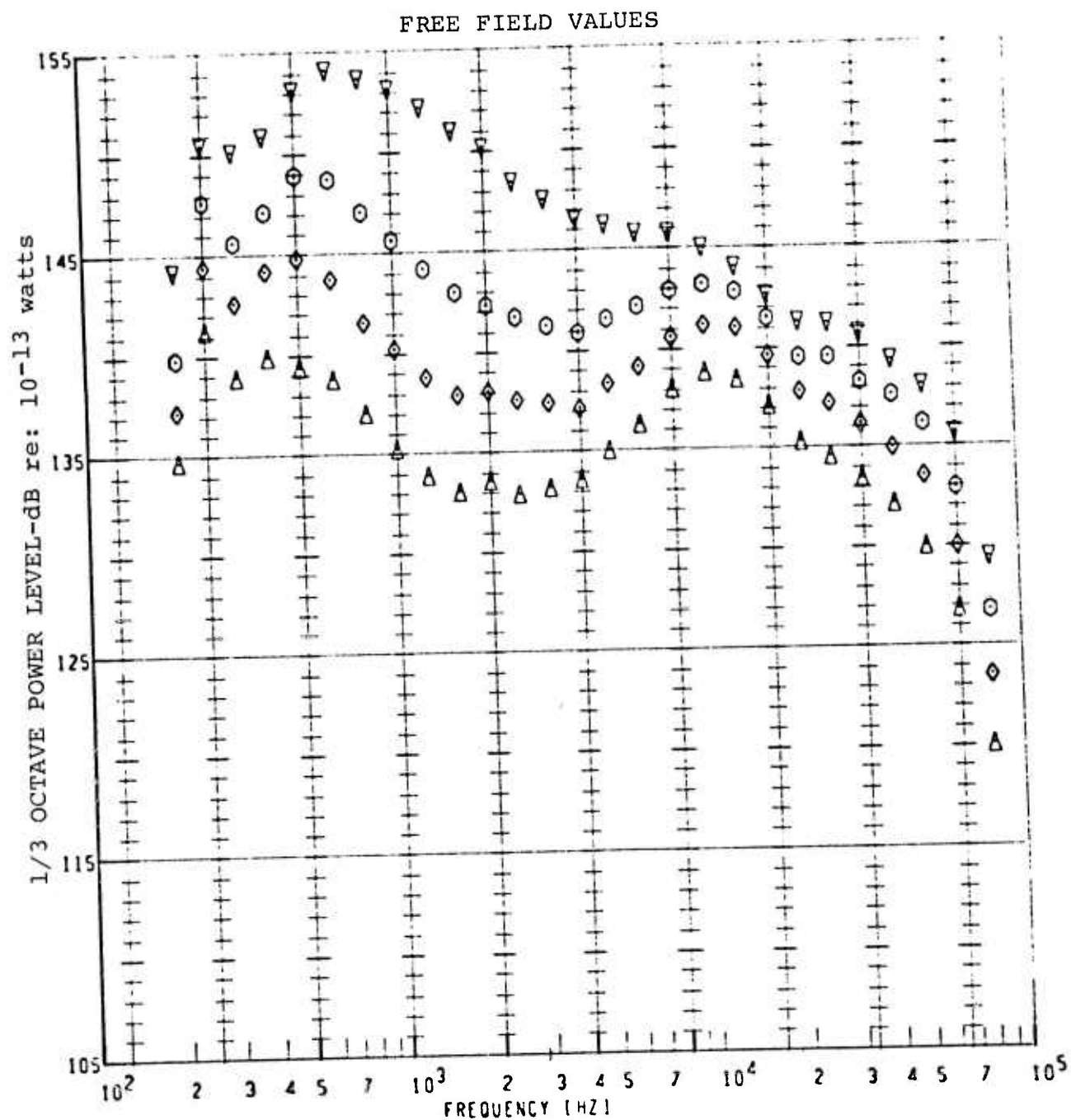
T_{AMB} = 48.5°F

R.H. = 68%

SCALE MODEL $A_8 = 13.6 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
239	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126	" "	
"	3.0	"	2303	" "	
"	4.0	"	2544	" "	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

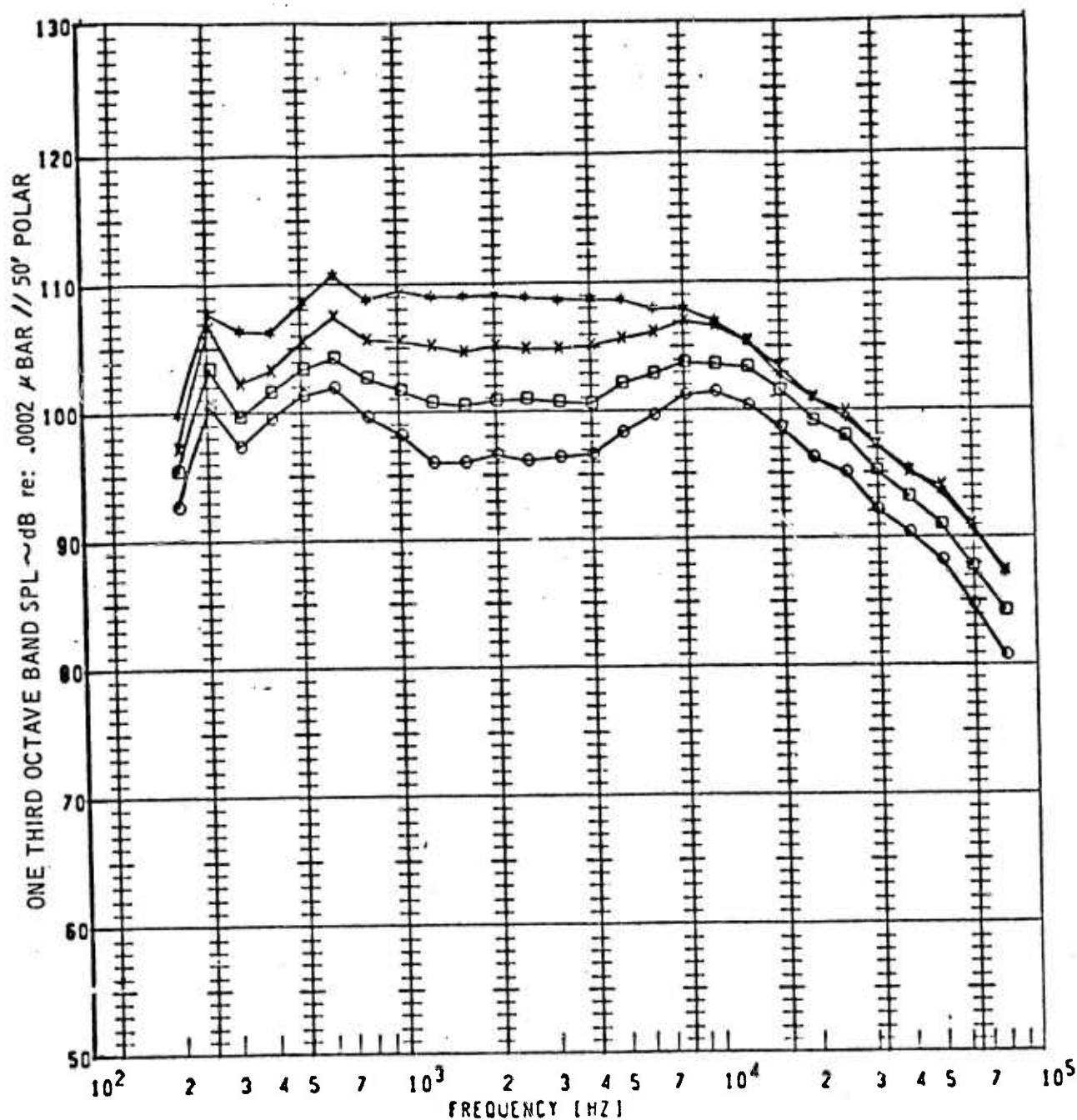


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	239	2.00	1150°F
◆	239	2.50	1150
○	239	3.00	1150
▼	239	4.00	1150

NOZZLE: 61T-3.3AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

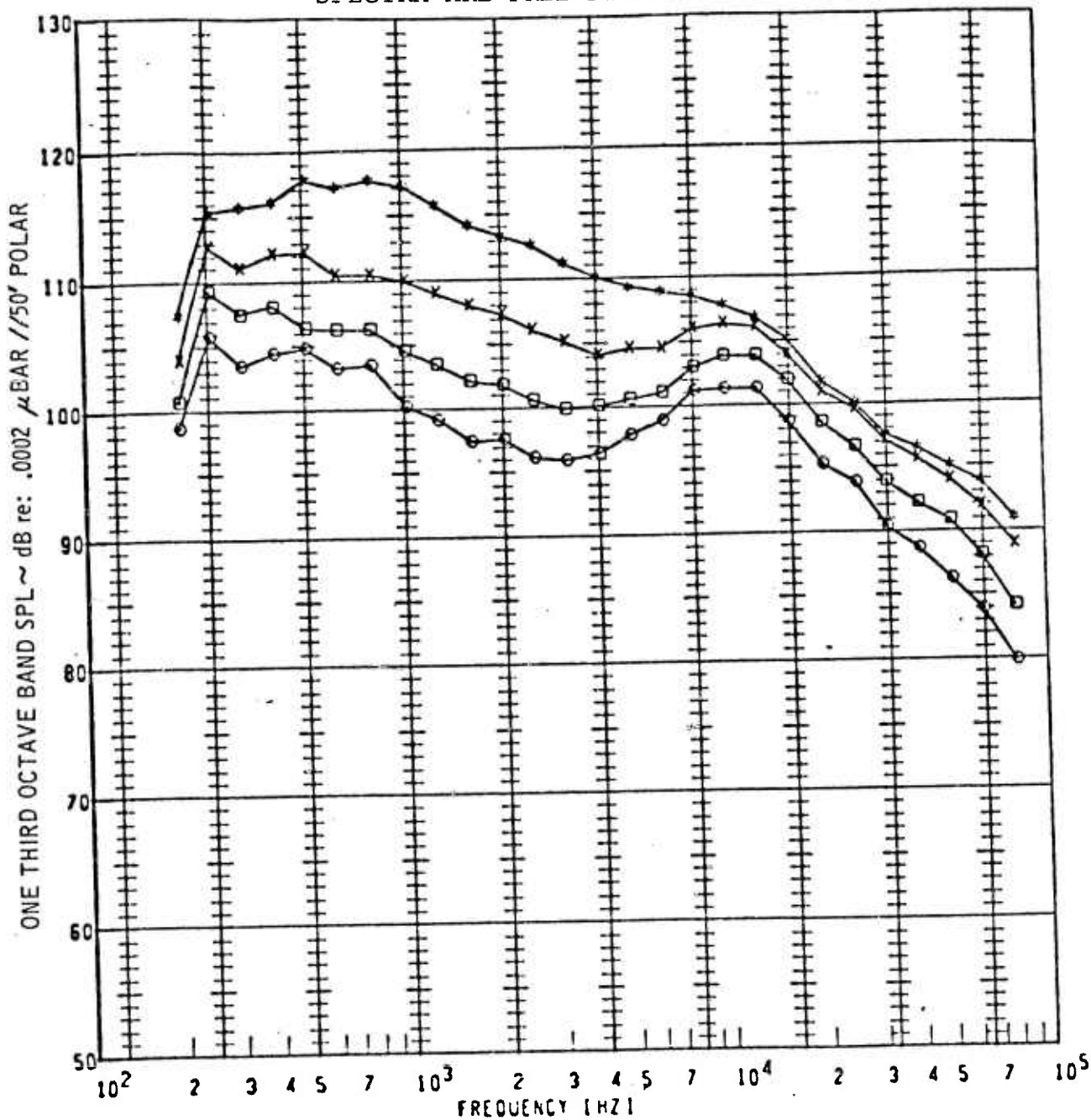


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
o	239G	1150°F	2.000	110°	50FP	112.3
□	239G	1150	2.500	↓	50FP	115.3
x	239G	1150	3.000	↓	50FP	118.5
*	239G	1150	4.000	↓	50FP	121.1

NOZZLE : .61T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

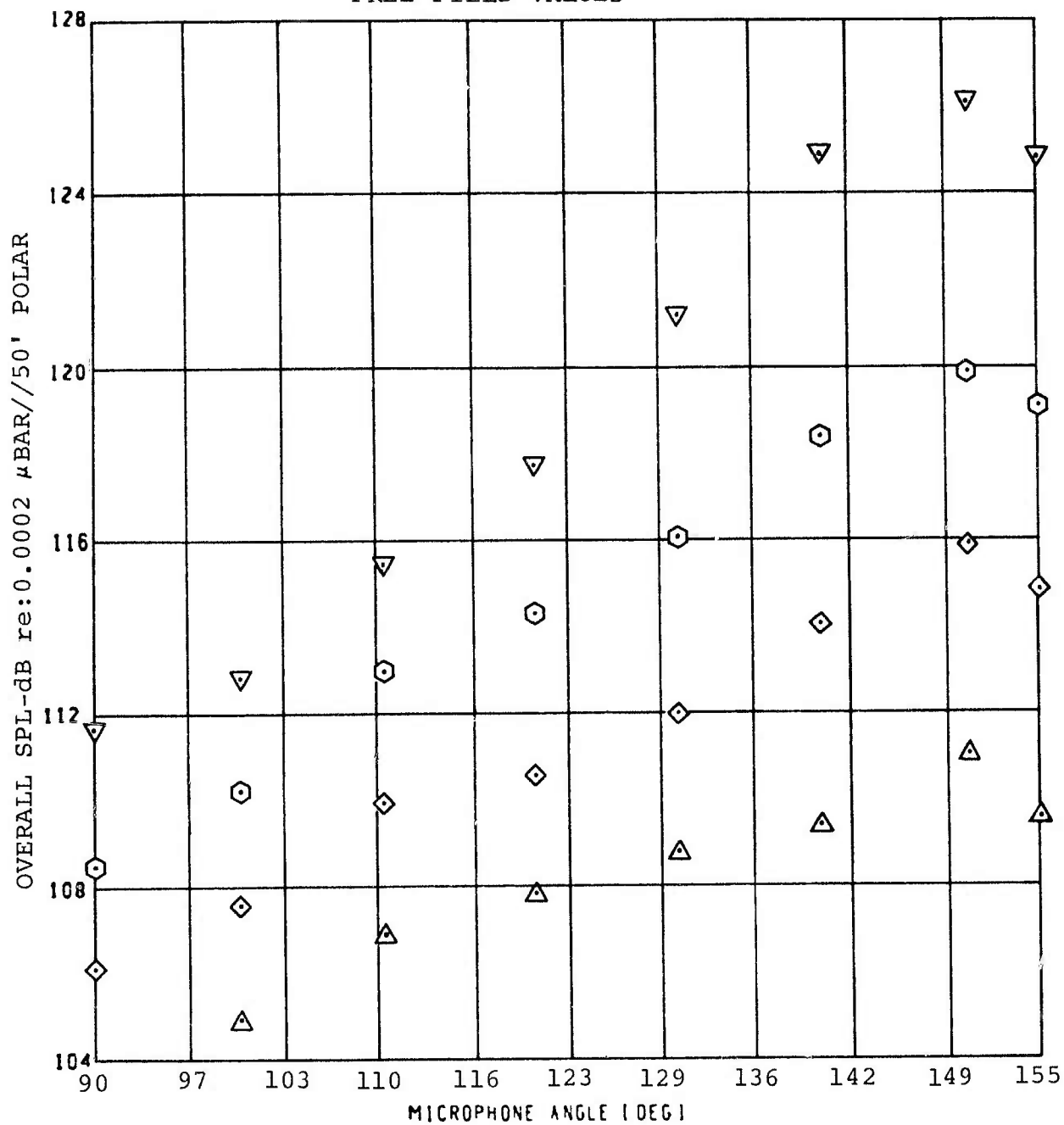


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
○	239G	1150°F	2.000	130°	50FP	114.5
□	239G	1150	2.500	↓	50FP	117.6
x	239G	1150	3.000		50FP	121.8
*	239G	1150	4.000		50FP	127.1

NOZZLE: 61T-3.3AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

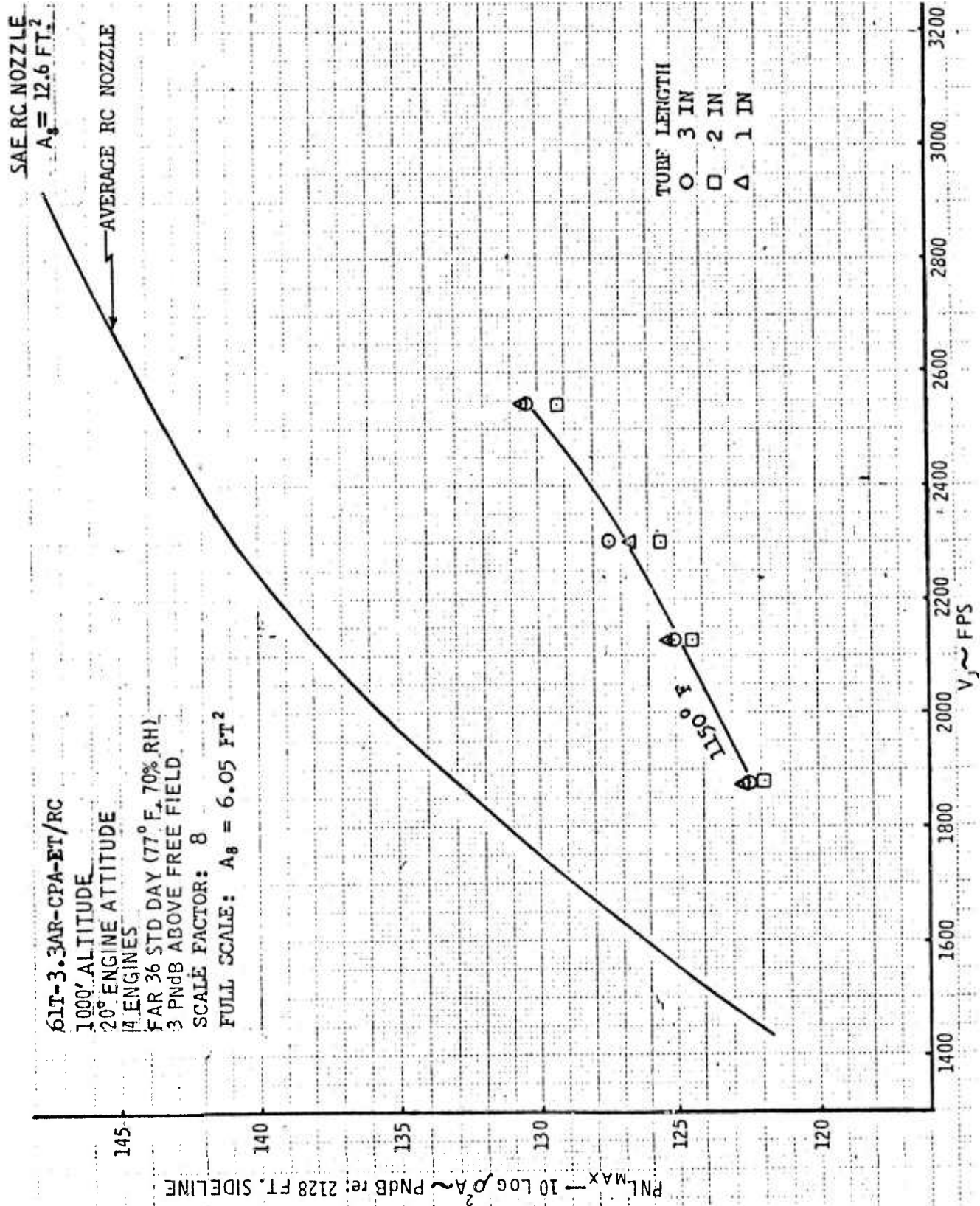
FREE FIELD VALUES



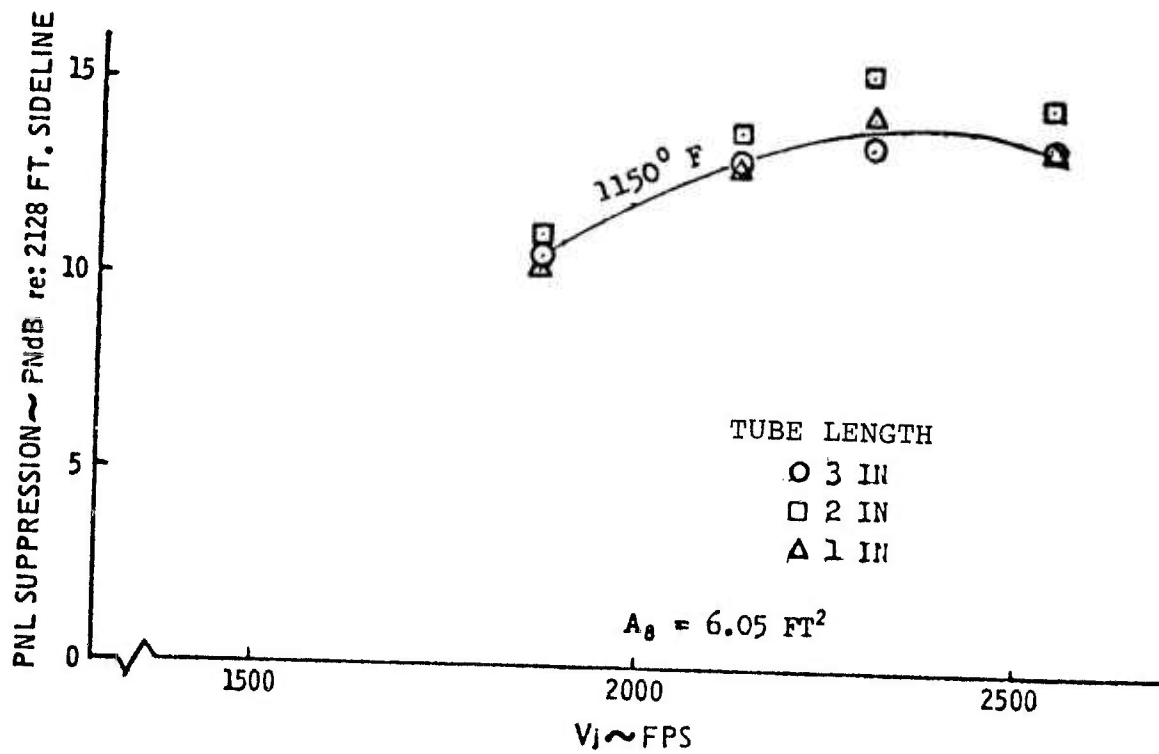
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	239	2.00	1150°F
◇	239	2.50	1150
○	239	3.00	1150
▽	239	4.00	1150

NOZZLE: 61T-3.3AR-CPA-ET/RC

OASPL BEAM PATTERNS

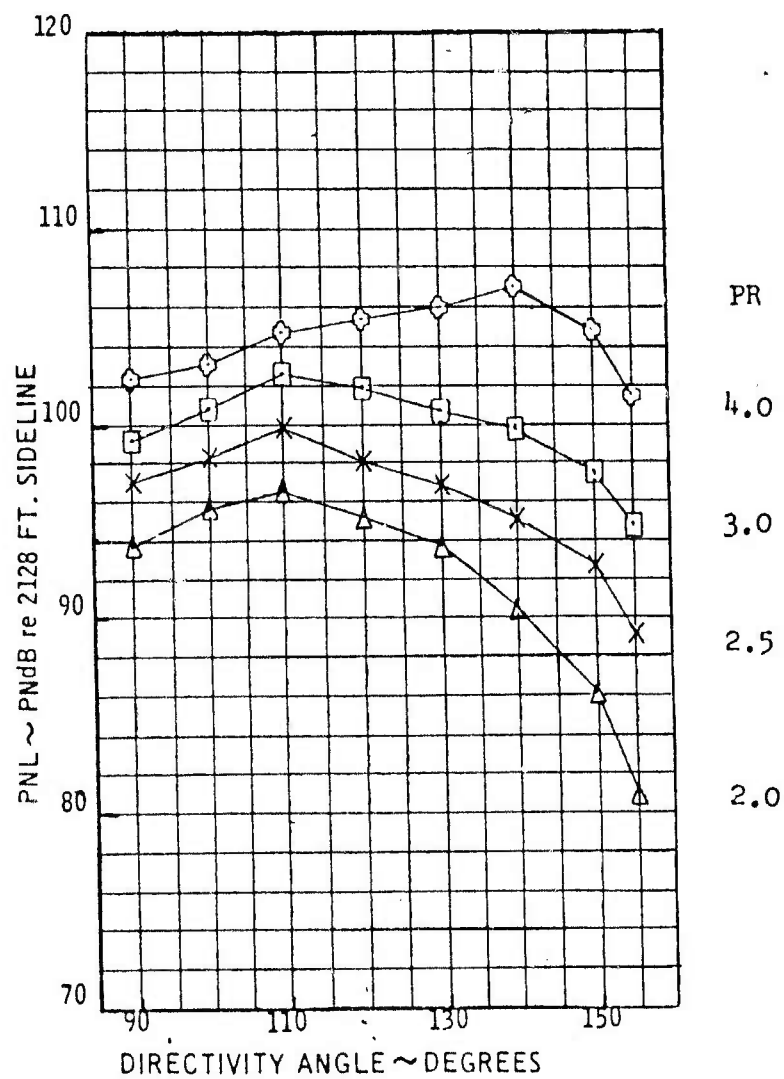


61T-3.3AR-CPA-ET/RC



PEAK PNL SUPPRESSION VALUES

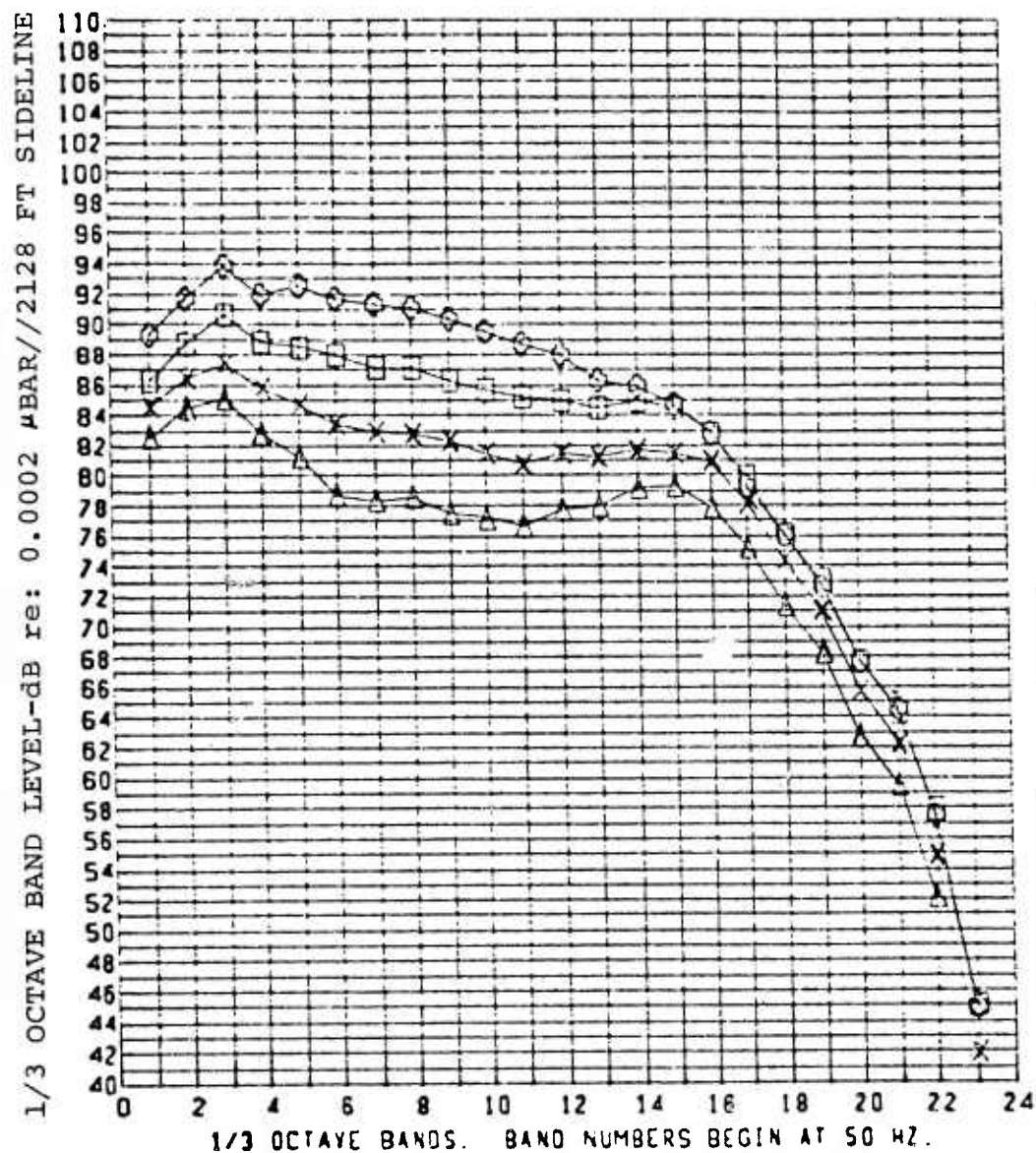
NOZZLE: 61T-3.3AR-CPA-ET/RC



RUN 239
 $T_T = 1150^\circ F$ $A_8 = 6.05 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



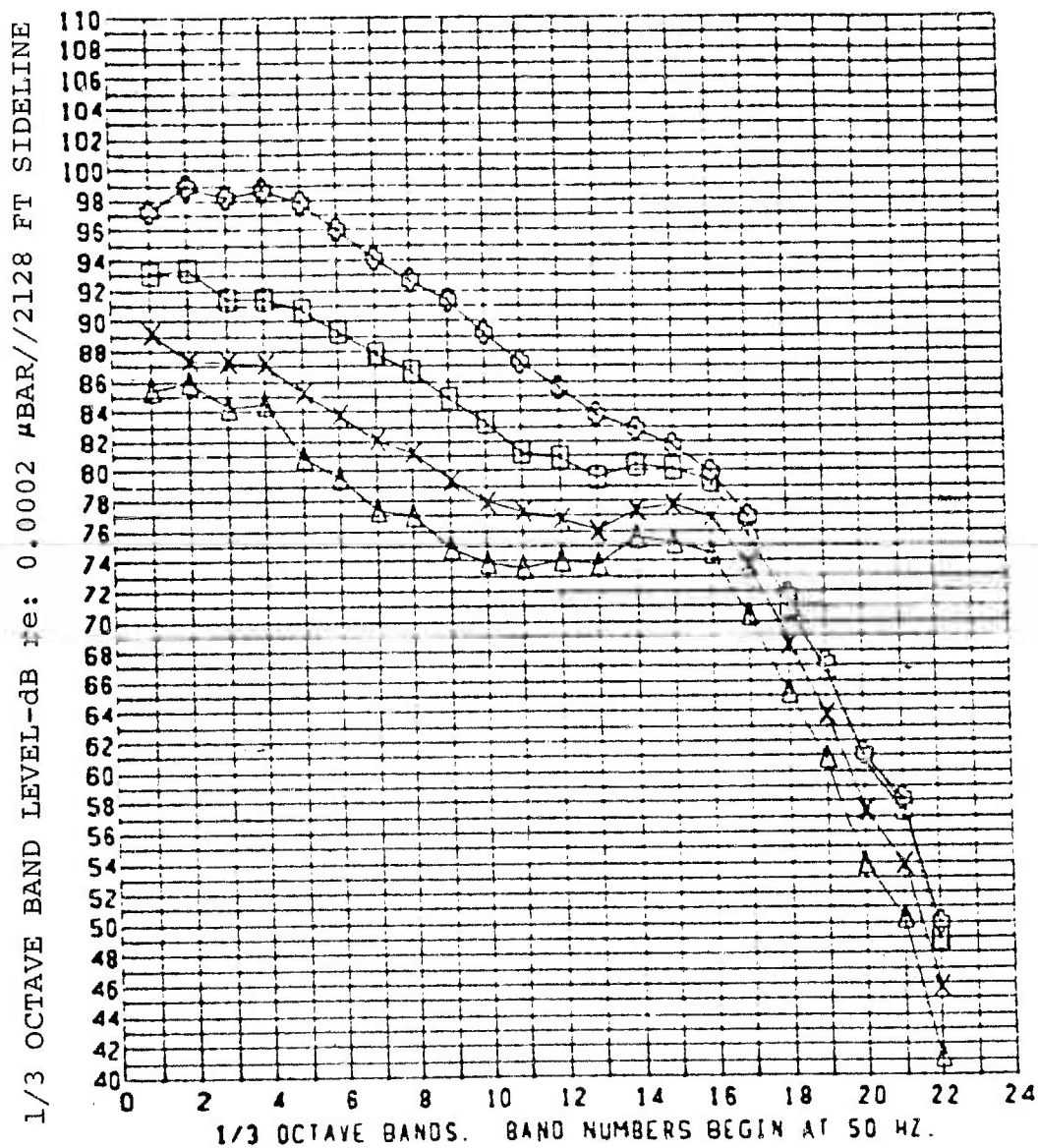
Tt = 1150°F A8 = 6.05 FT² RUN: 239
 PR = Δ 2.0, X 2.5, □ 3.0, + 4.0

NOZZLE: 61T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT.
 SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



Tt = 1150°F A8 = 6.05 FT² RUN:239

PR = Δ 2.0, X 2.5, □ 3.0, + 4.0

NOZZLE: 61T-3.3AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT.
SIDELINE, 130° re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 61T-3.3AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 20, 1973

P_{AMB} = 30.06 in Hg **T_{AMB}** = 39°F **R.H.** = 92%

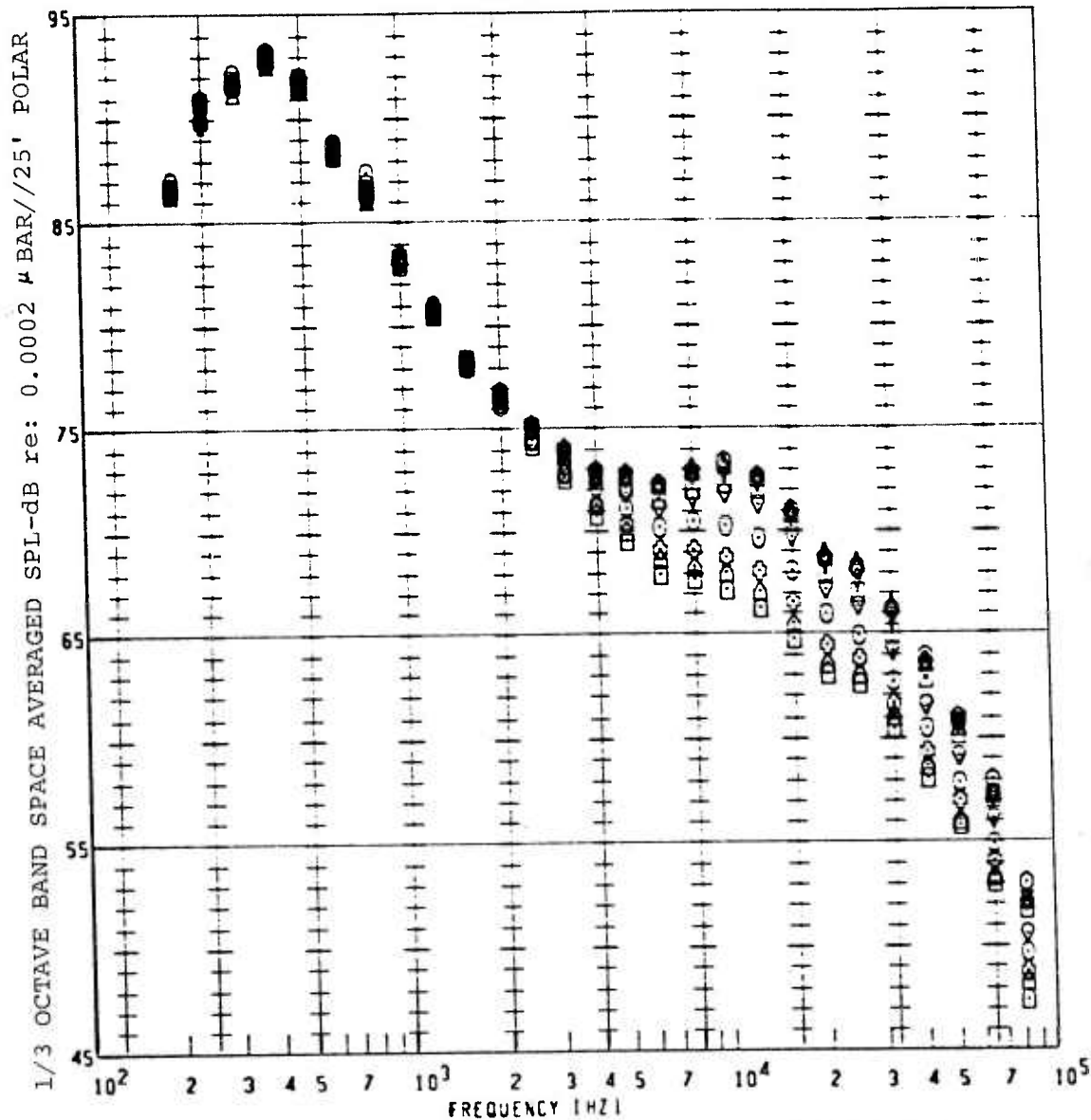
NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
124	0.0 x/D	9.0 in.		
125	0.25	9.0		
126	0.50	10.0		
127	0.75	10.0		
128	1.00	10.0		
129	1.25	10.5		
130	1.50	10.5		
131	1.75	11.0		
132	2.00	11.0		
133	2.25	11.5		
134	2.50	11.5		
135	2.75	12.0		
136	3.0	13.0		
137	3.5	14.0		
138	4.0	15.0		
139	5.0	16.0		
140	6.0	18.0		
141	8.0	19.0		
142	10.0	21.0		
143	12.0	23.0		
144	14.0	25.0		
145	16.0	27.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

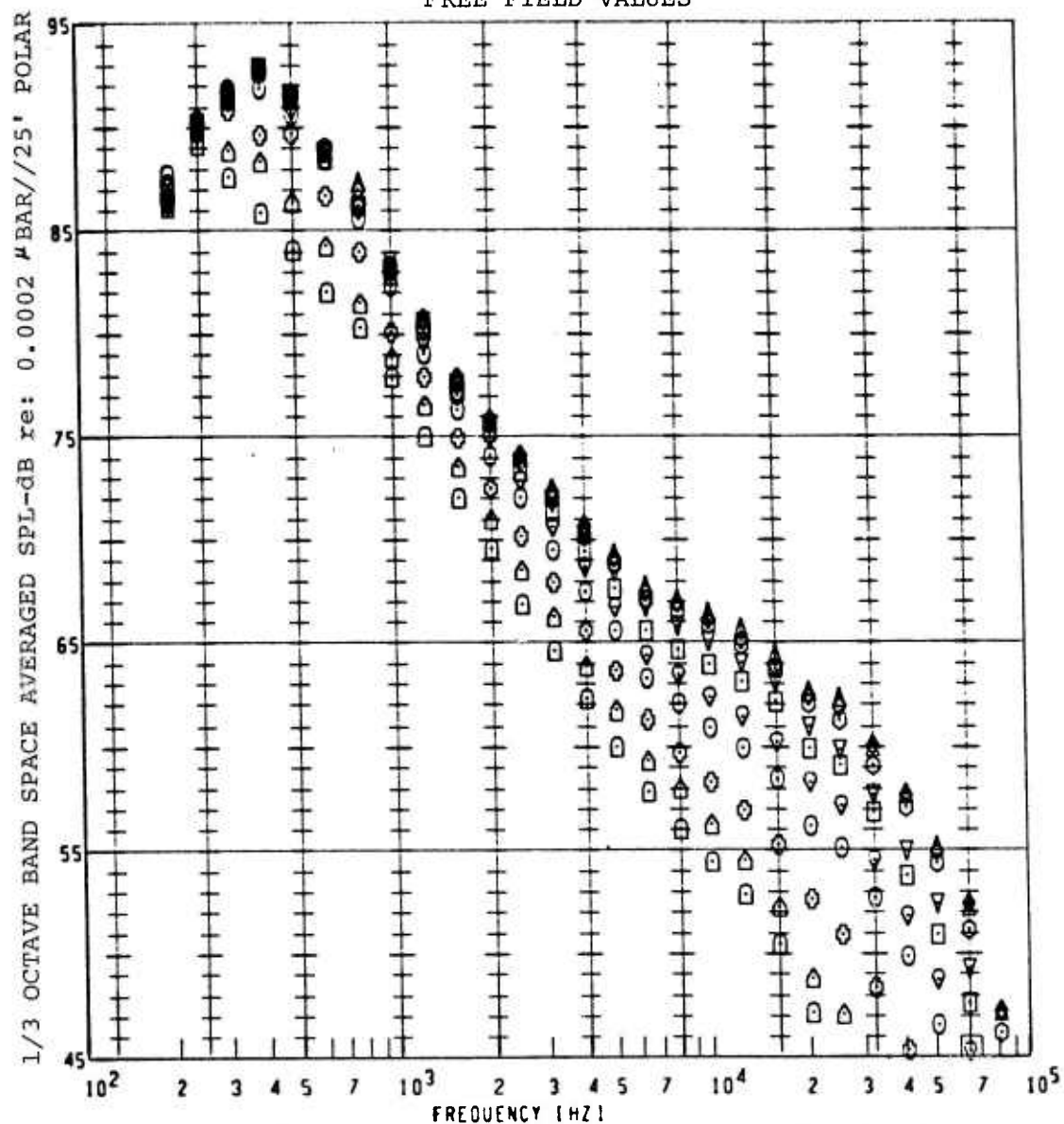


PLOT SYMBOL	RUN NUMBER
Δ	124
◊	125
○	126
▽	127
◻	128
◐	129
◑	130
◒	131
◓	132
◔	133

JET TEMP
1150°F
1150
1150
1150
1150
1150
1150
1150
1150
1150

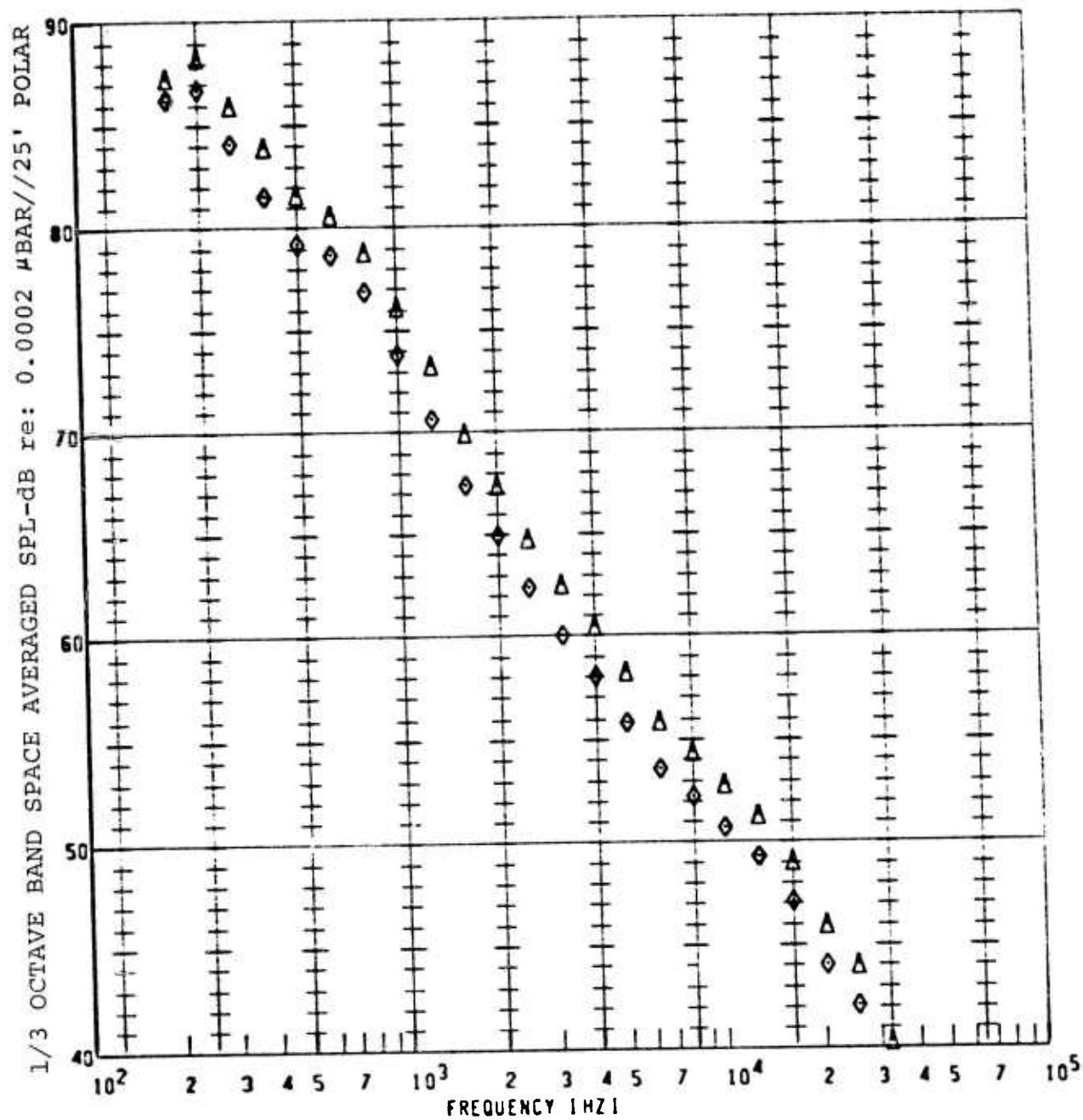
PRESSURE RATIO	AXIAL LOCATION, x/D
3.000	0.0
	0.25
	0.5
	0.75
	1.0
	1.25
	1.50
	1.75
	2.00
	2.25

FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	134	1150 °F	3.000	2.50
◇	135	1150		2.75
○	136	1150		3.00
▽	137	1150		3.50
□	138	1150		4.00
◊	139	1150		5.00
○	140	1150		6.00
◇	141	1150		8.00
△	142	1150		10.00
□	143	1150		12.00

FREE FIELD VALUES



PLOT
SYMBOL

Δ
◊

RUN
NUMBER

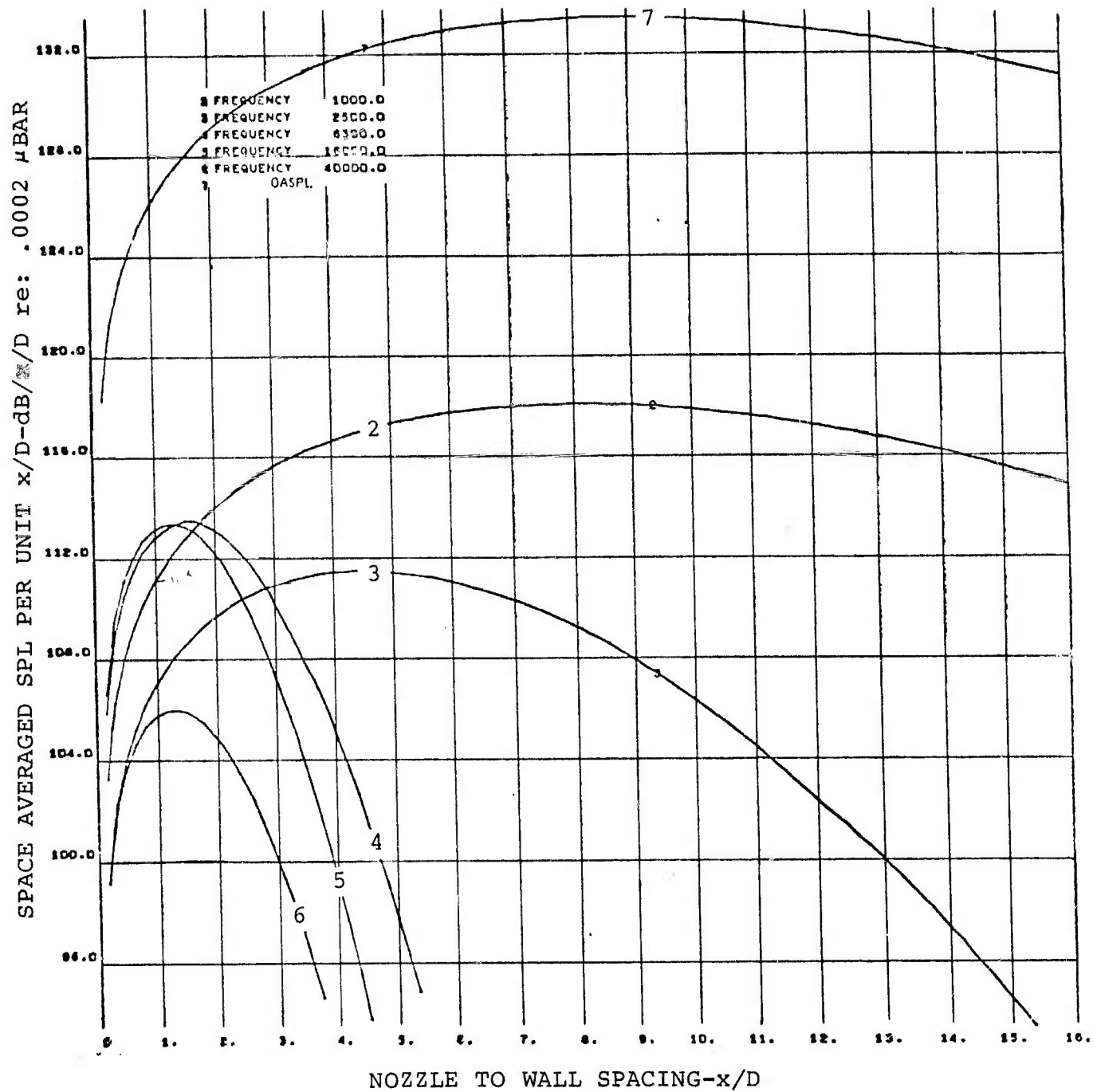
144
145

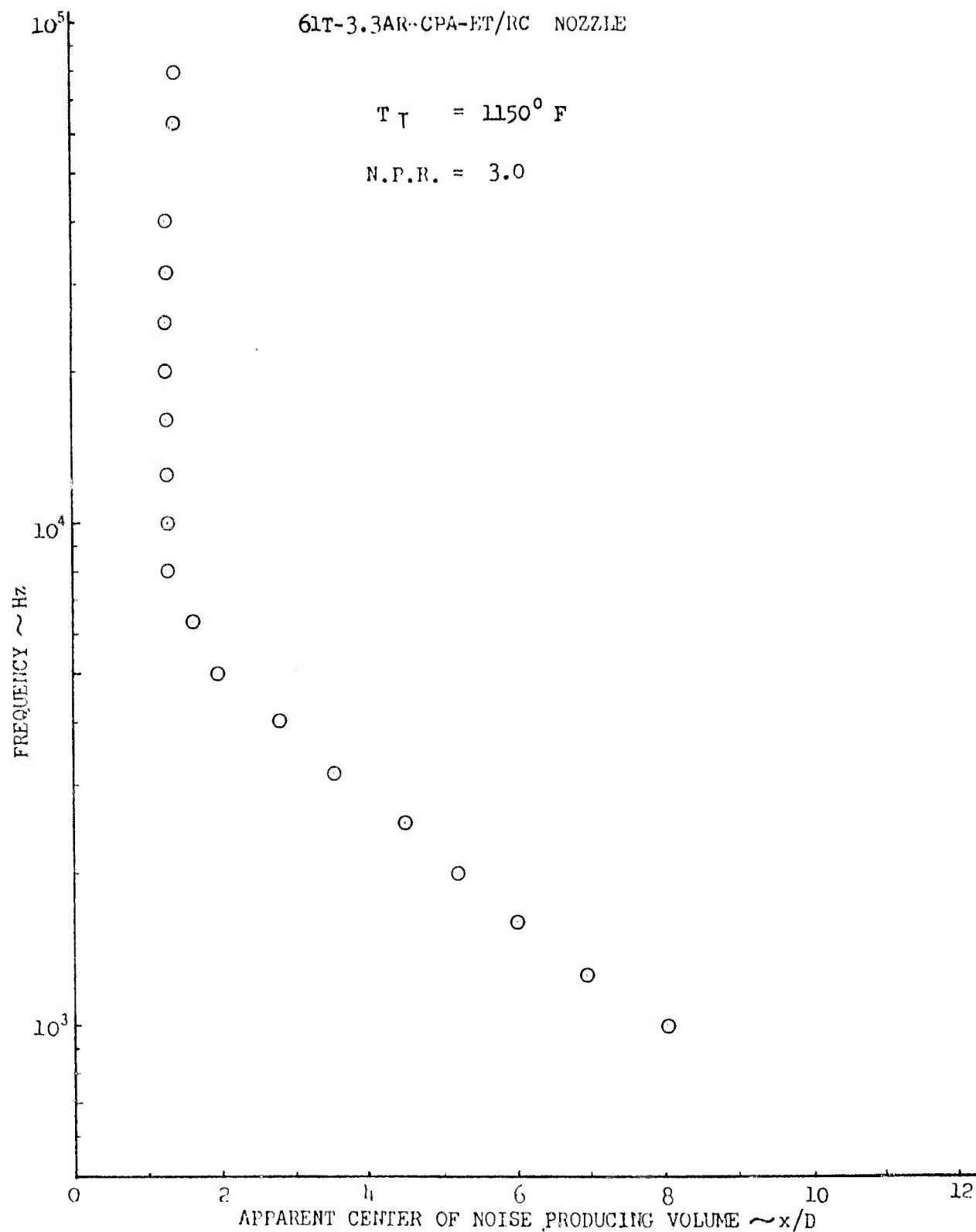
JET
TEMP

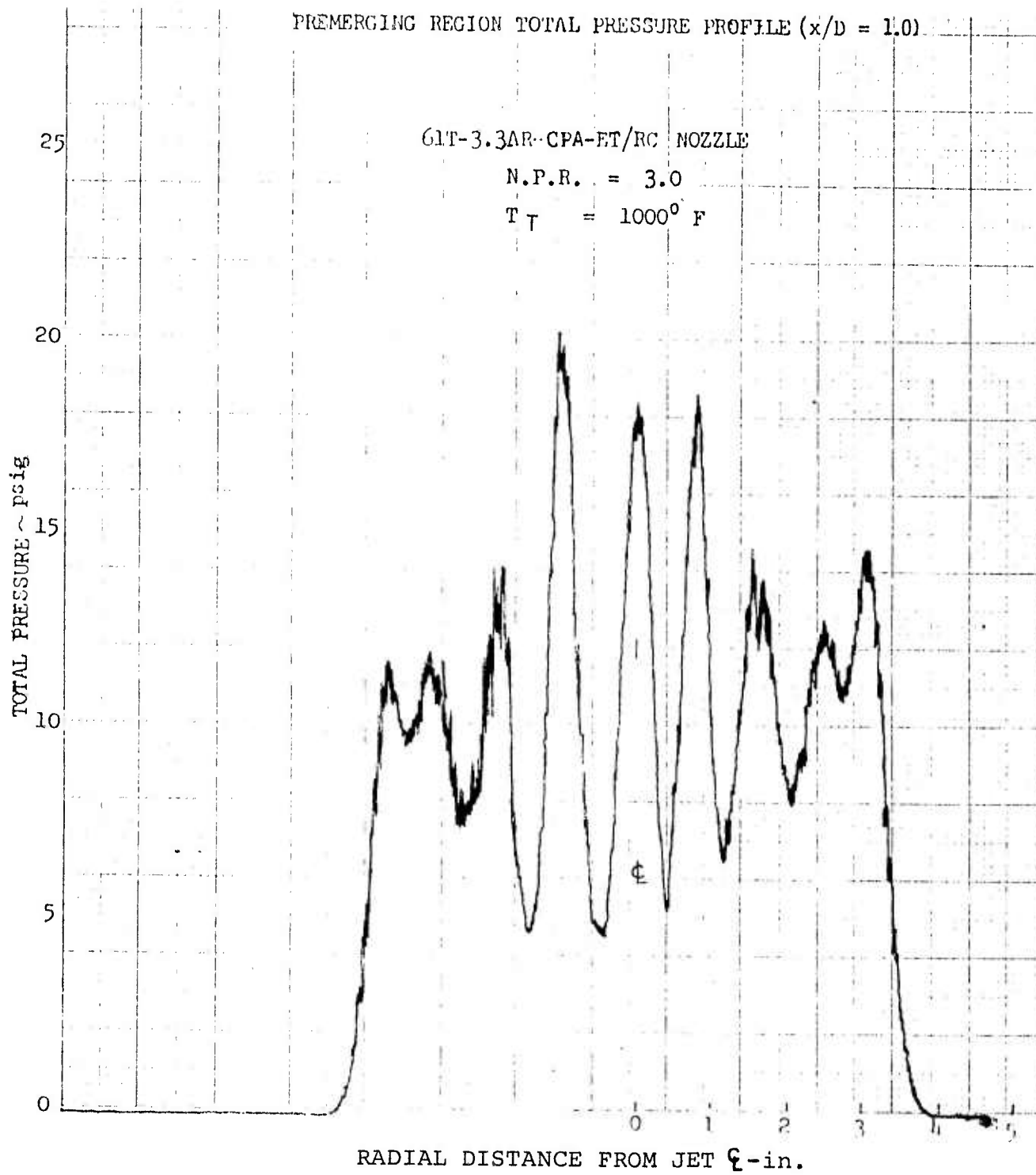
1150°F
1150

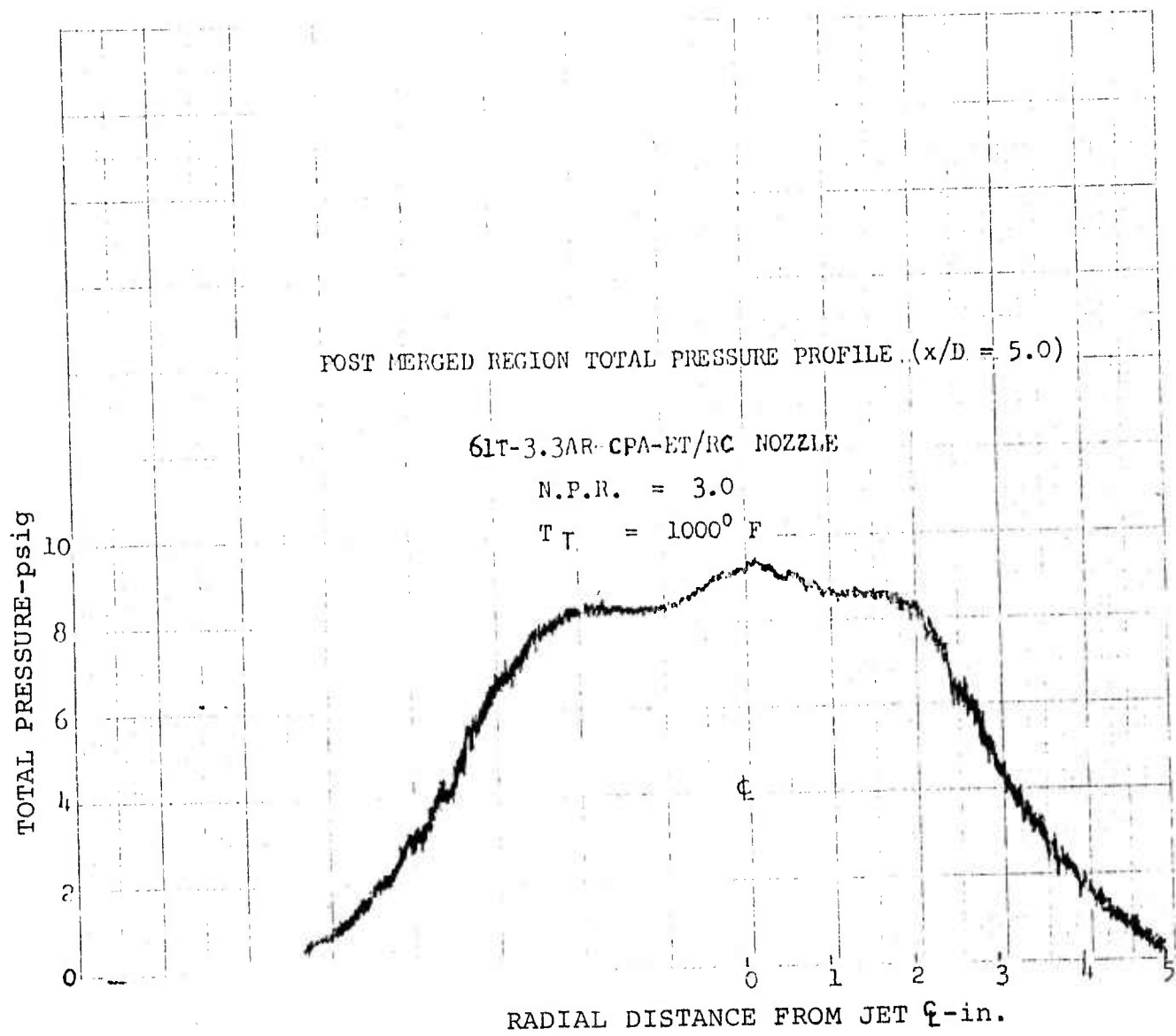
PRESSURE AXIAL
RATIO LOCATION, x/D

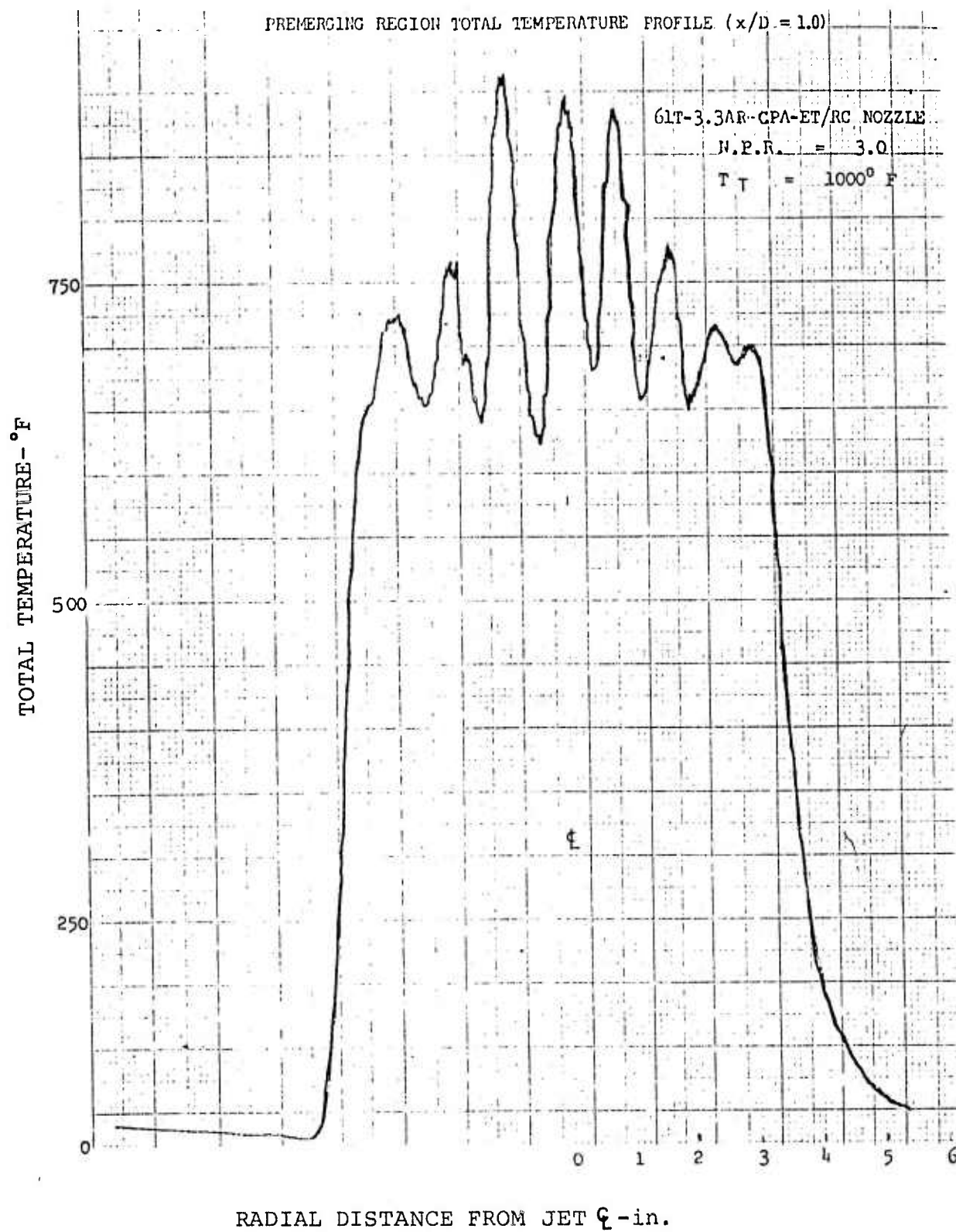
3.0 14.00
3.0 16.00

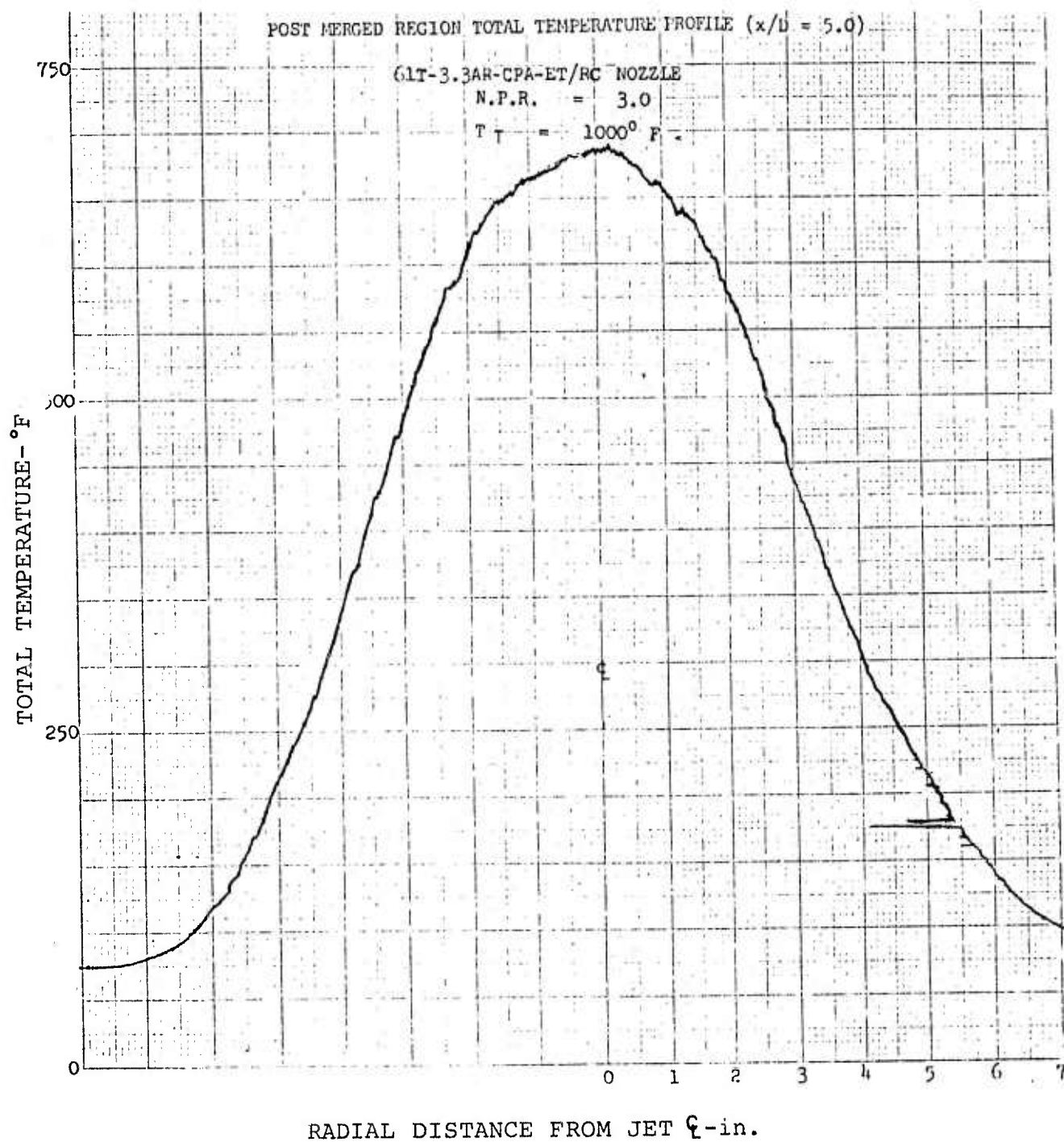


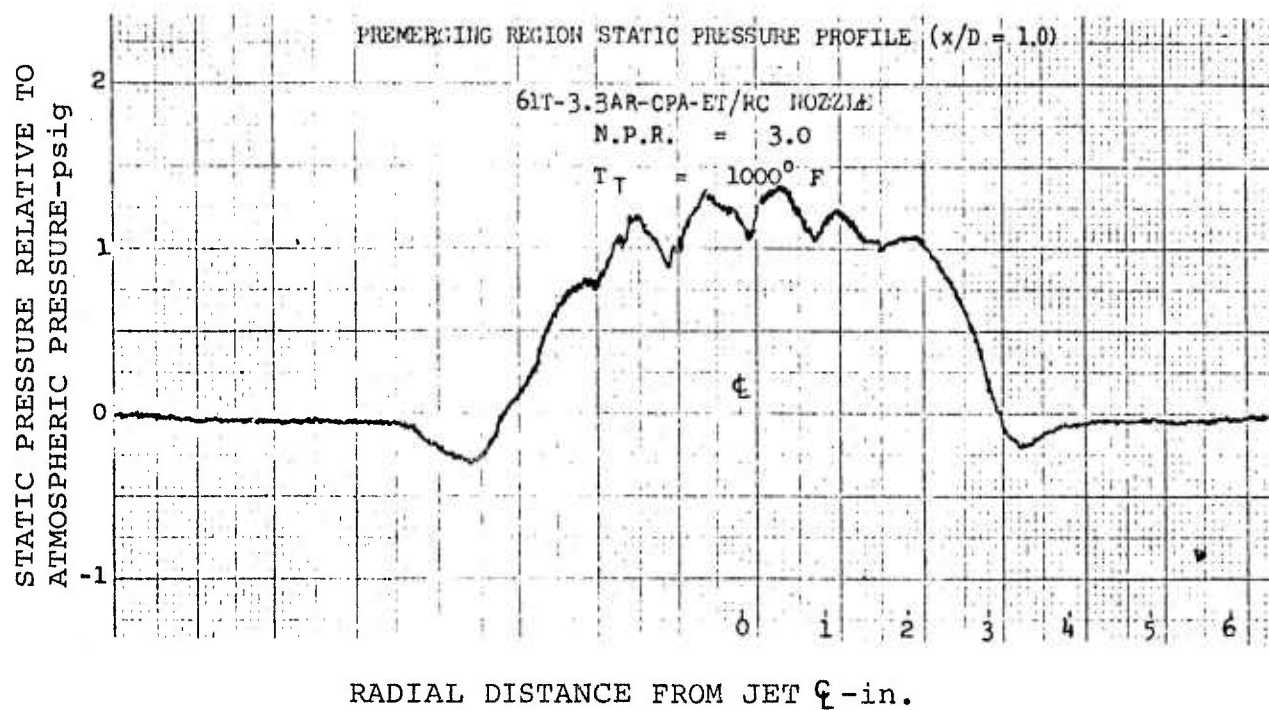


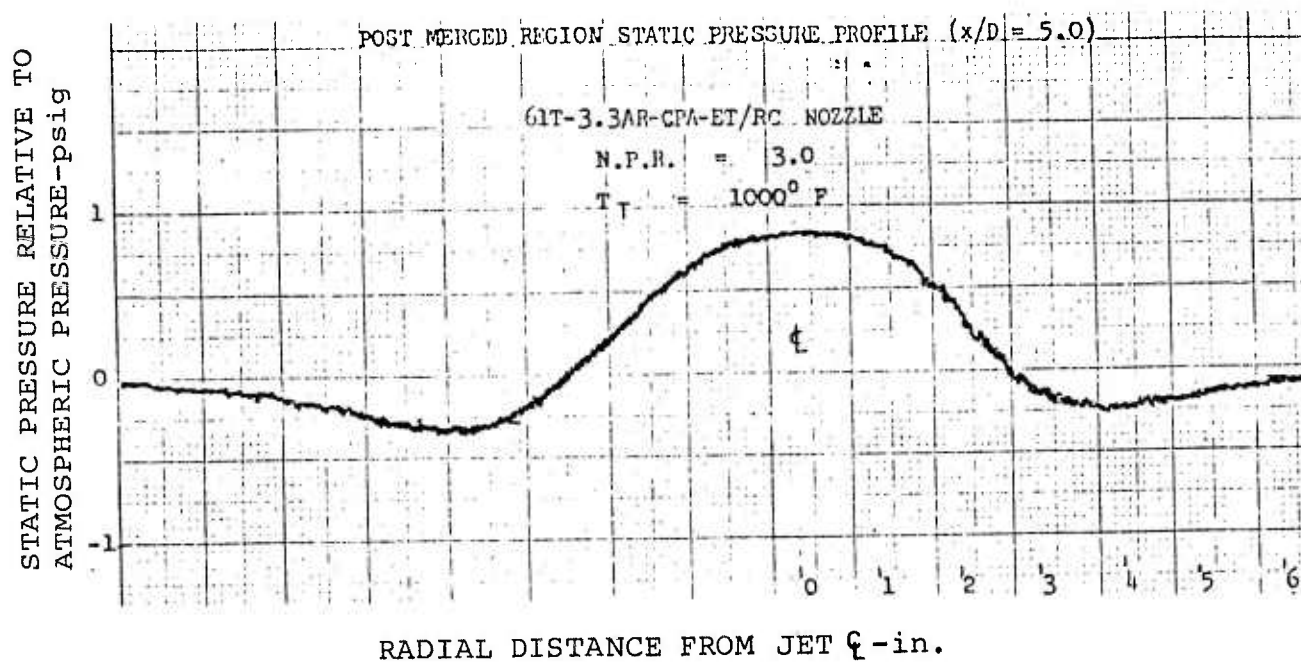


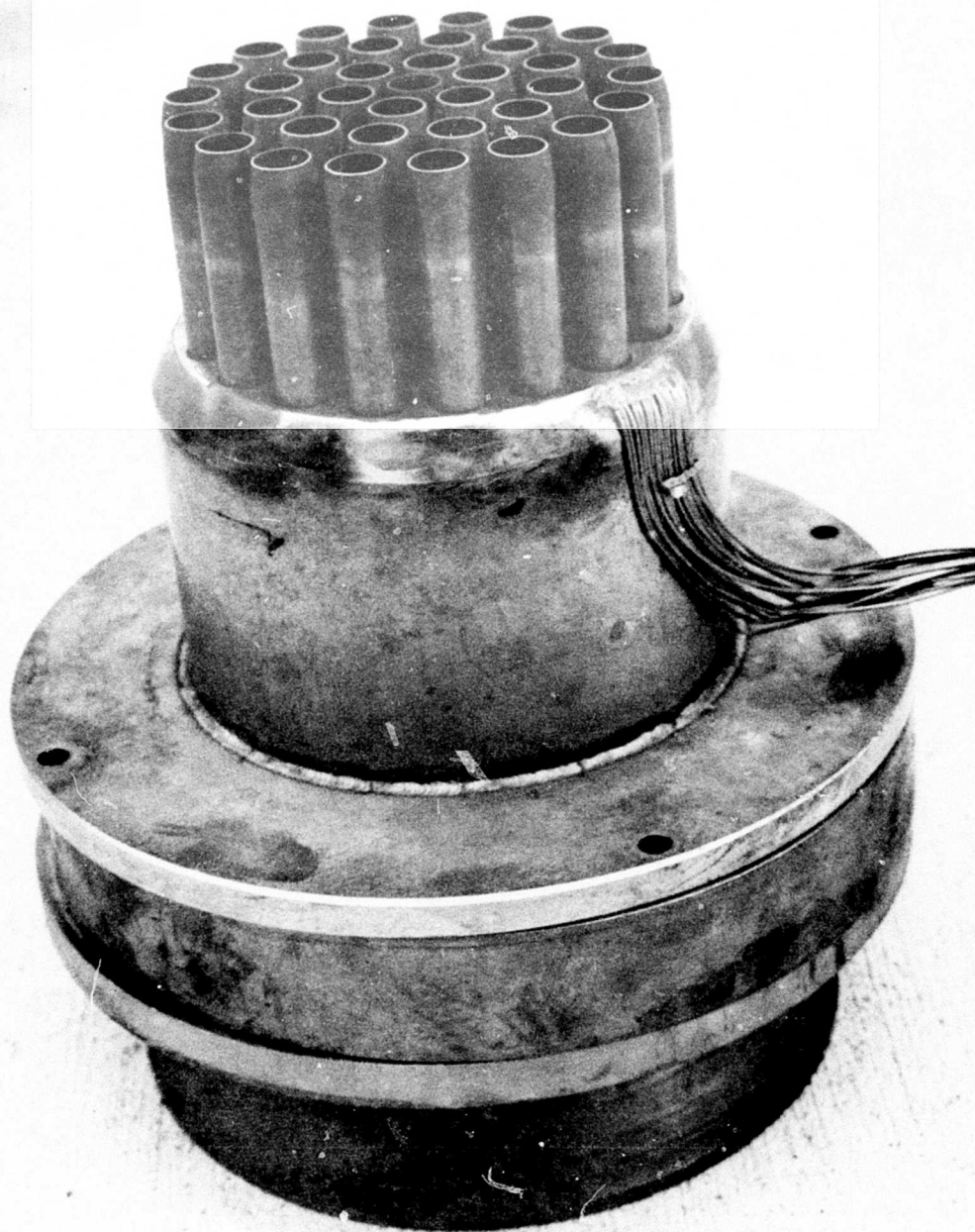




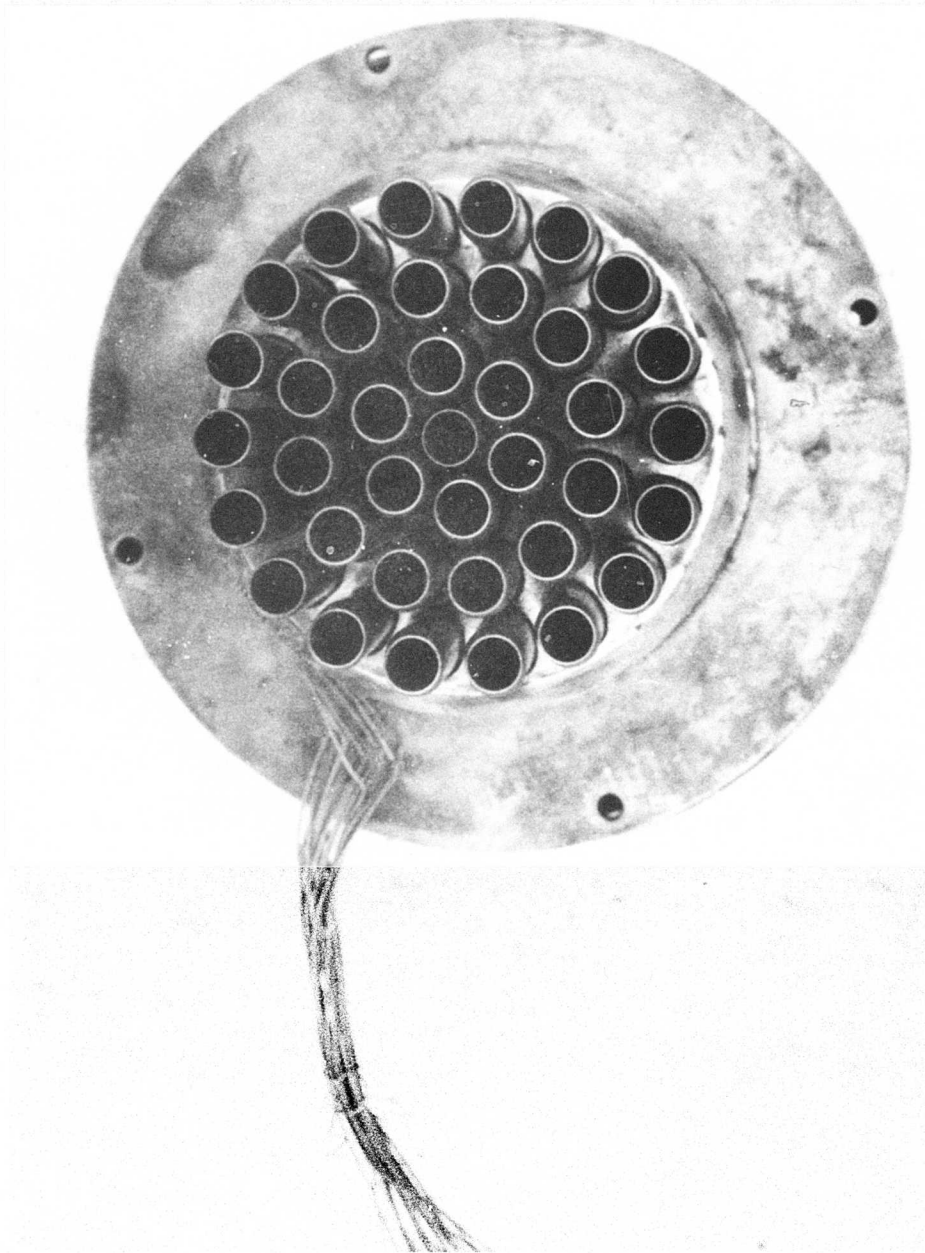




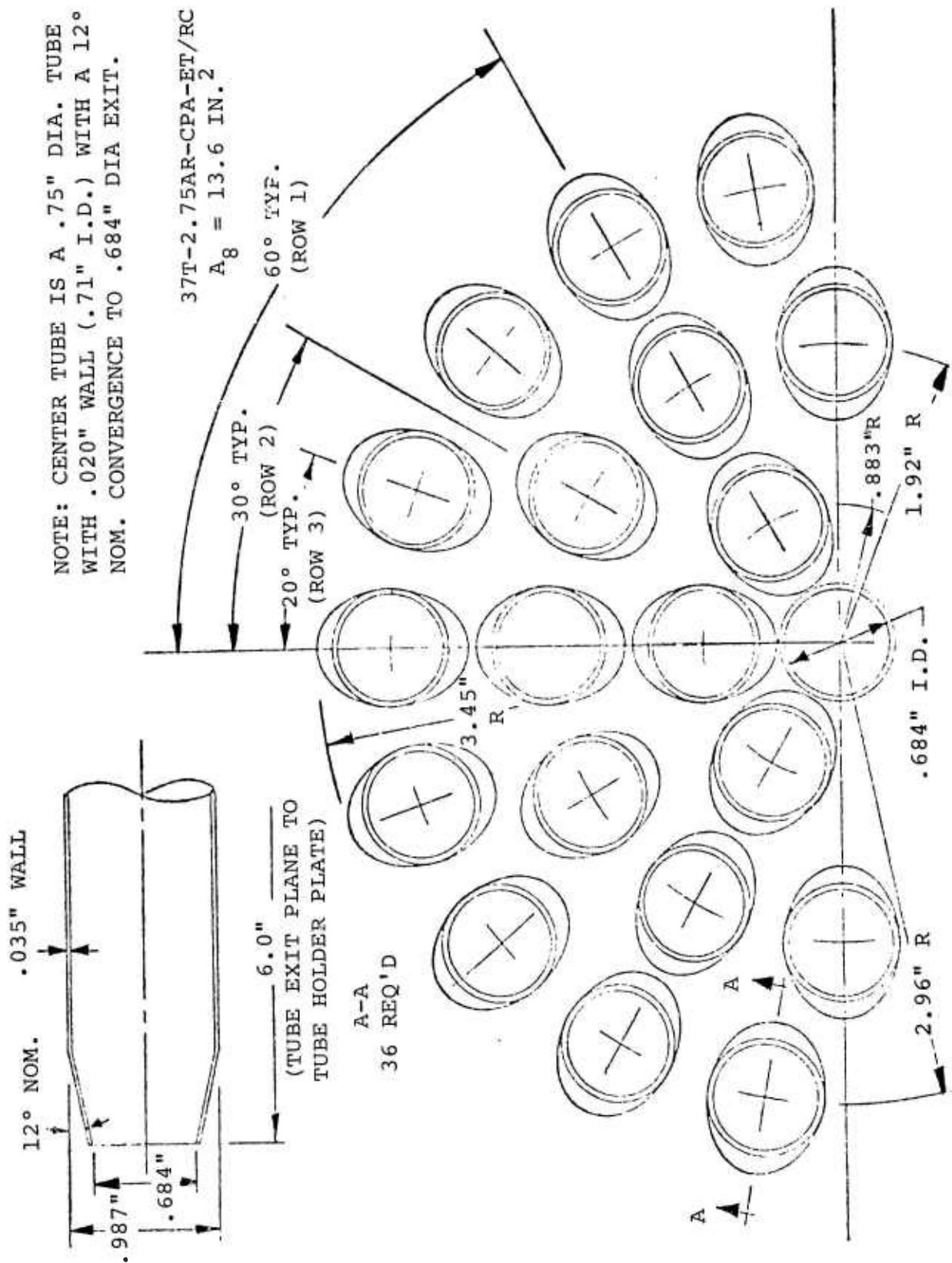




37T-2.75AR-CPA-ET/RC NOZZLE



37T-2.75AR-CPA-ET/RC NOZZLE



37 TUBE - AREA RATIO 2.75 ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-2.75AR-CPA-ET/RC

FACILITY: HNTF

DATE: 1-10-73

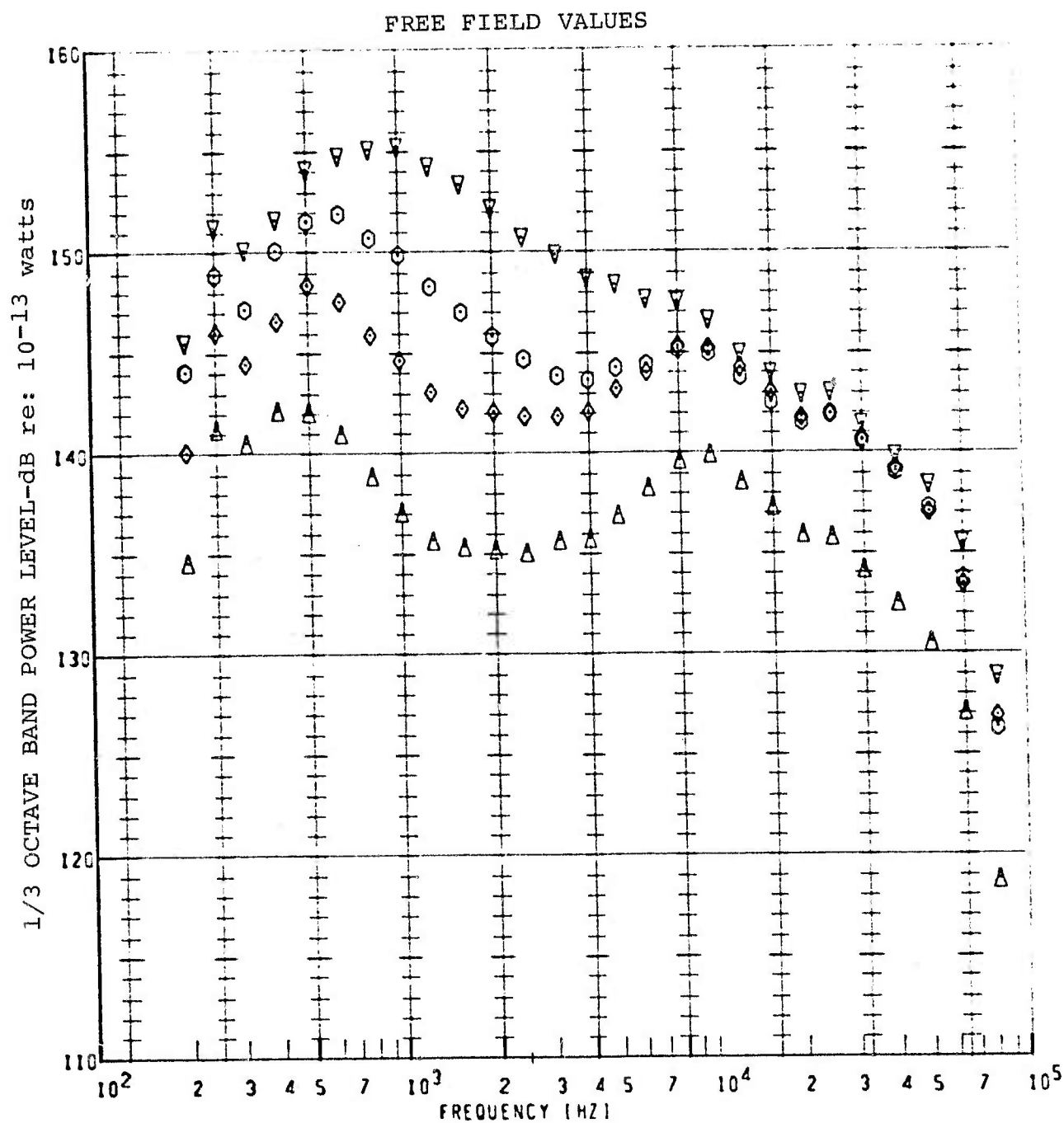
T_{AMB} = 42°F

R.H. = 72%

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
181	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

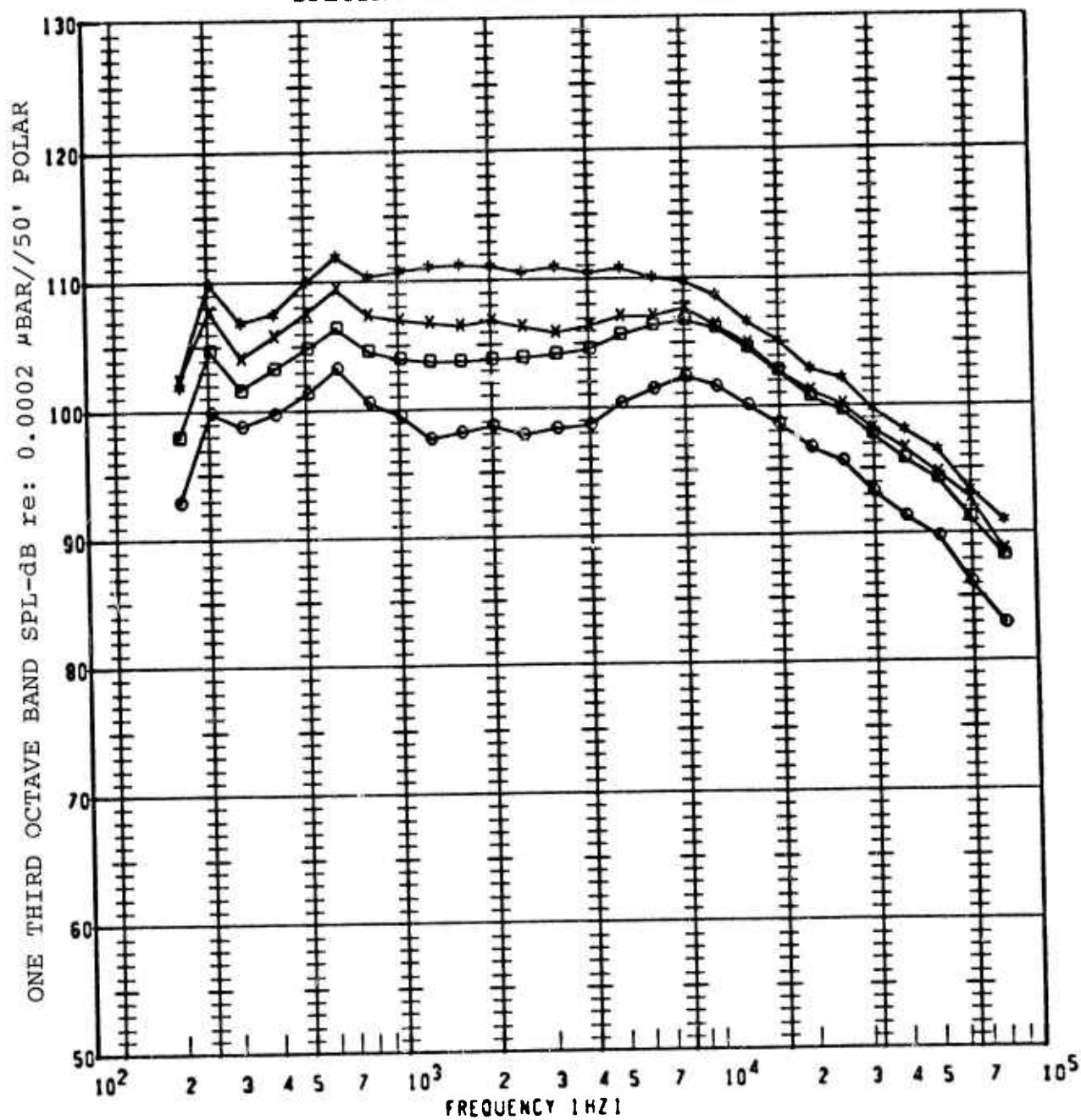


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	181	2.00	1150 °F
◇	181	2.50	1150
○	181	3.00	1150
▽	181	4.00	1150

NOZZLE: 37T-2.75AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

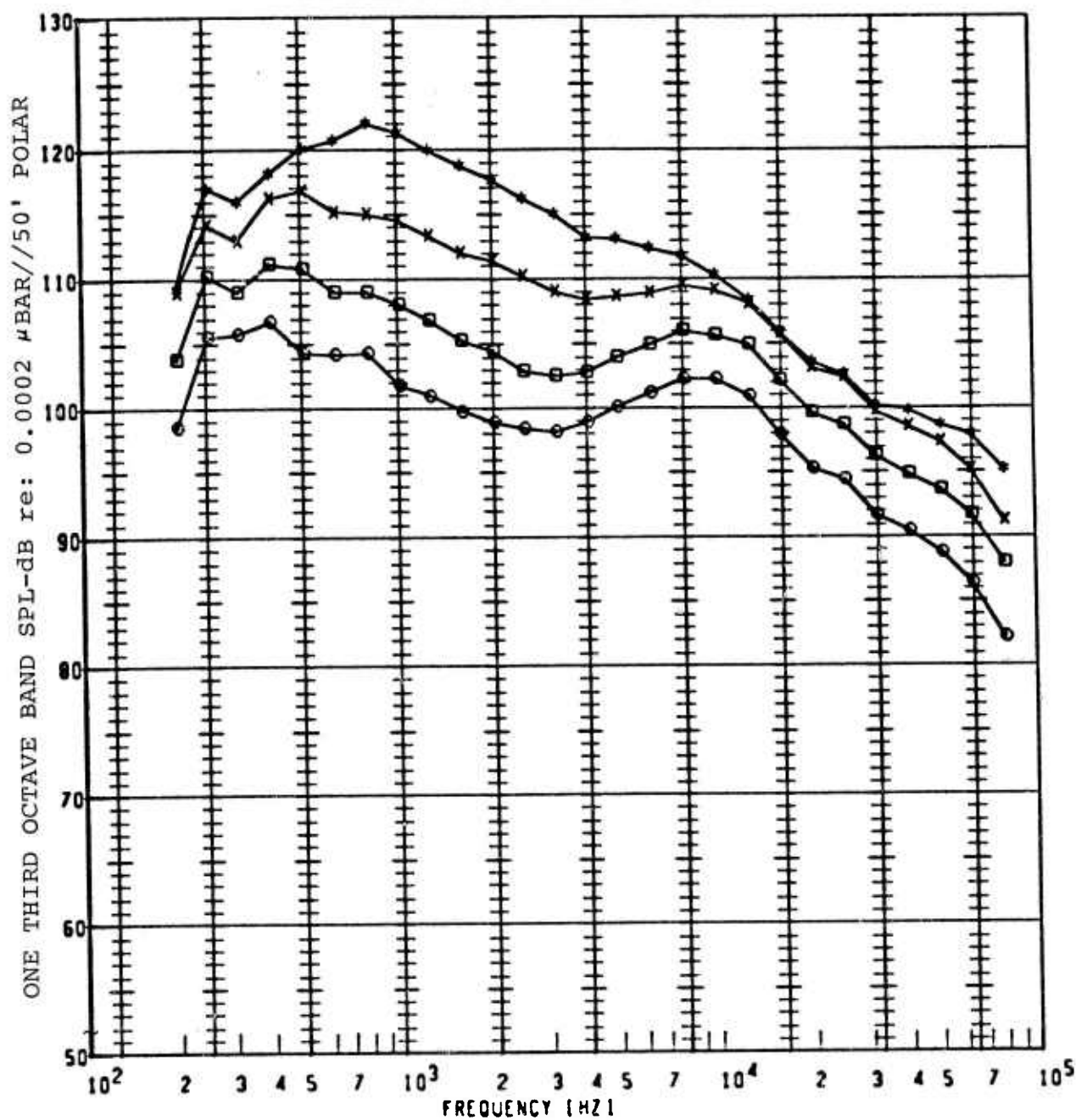


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
○	181G	1150°F	2.000	110°	50FP	113.2
□	181G	1150	2.500	↓	50FP	117.8
x	181G	1150	3.000	↓	50FP	119.8
*	181G	1150	4.000	↓	50FP	122.9

NOZZLE: 37T-2.75AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

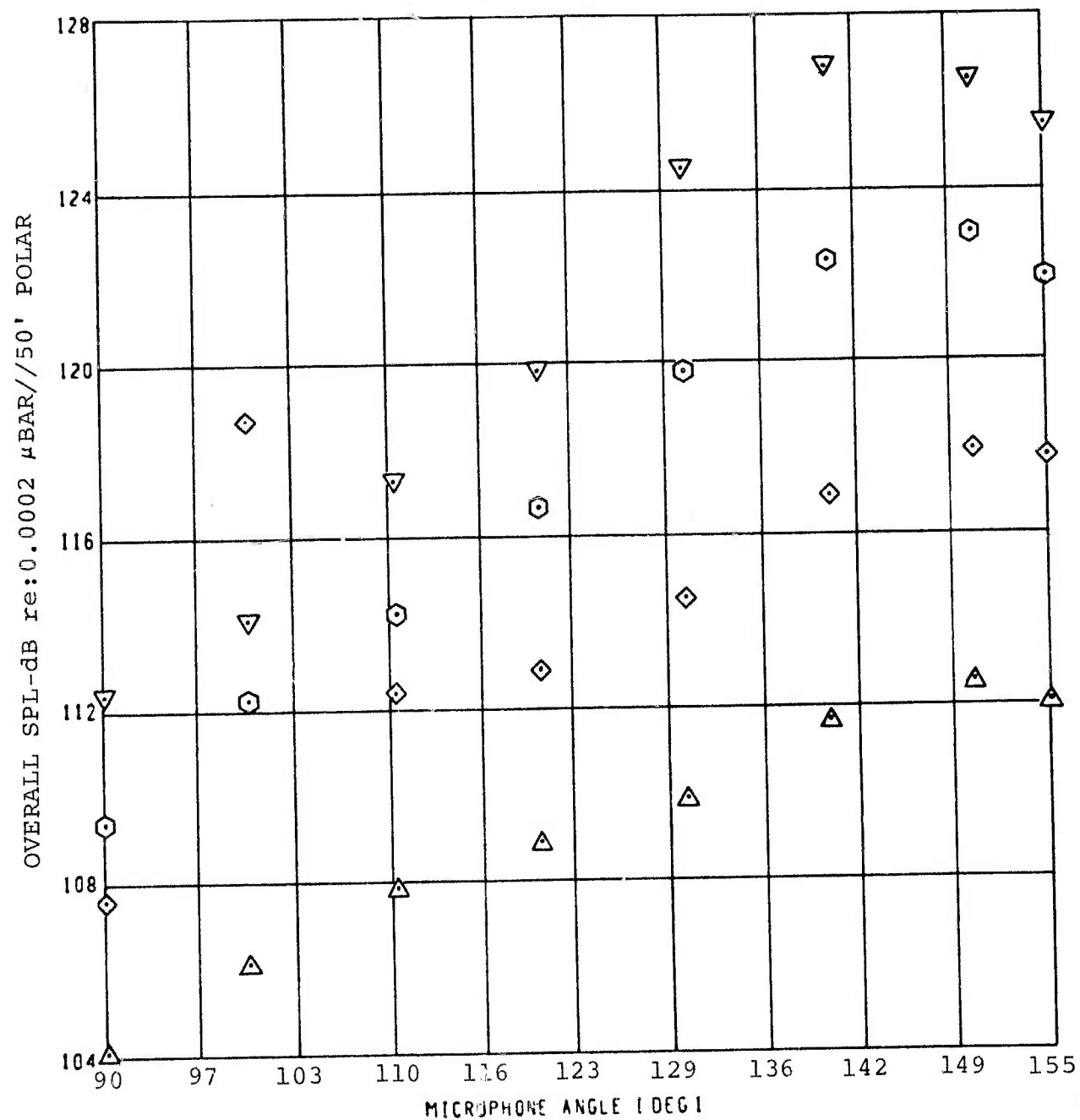


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL 1091
○	181G	1150°F	2.000	130°	50FP	115.6
◻	181G	1150	2.500	↓	50FP	120.2
x	181G	1150	3.000	↓	50FP	125.6
*	181G	1150	4.000	↓	50FP	130.4

NOZZLE: 37T-2.75AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

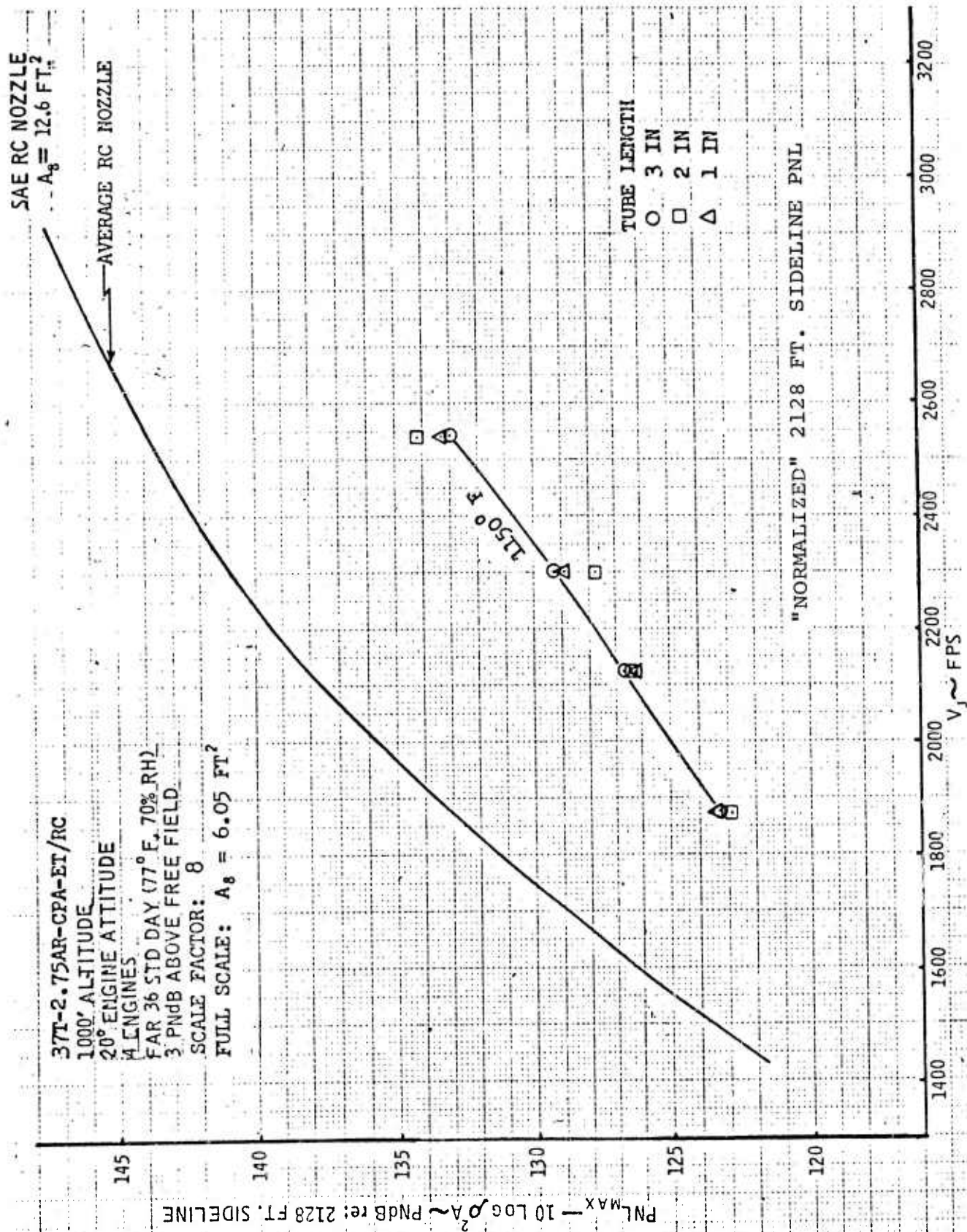
FREE FIELD VALUES



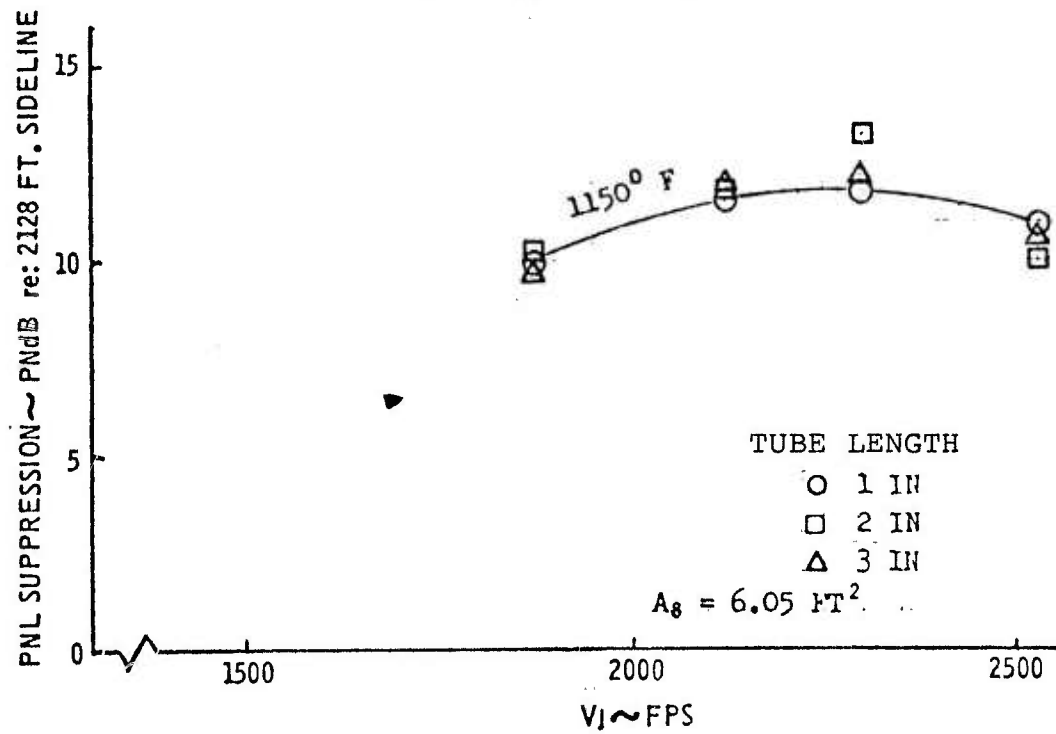
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	181	2.00	1150°F
◇	181	2.50	1150
○	181	3.00	1150
▽	181	4.00	1150

NOZZLE: 37T-2.75AR-CPA-ET/RC

OASPL BEAM PATTERNS

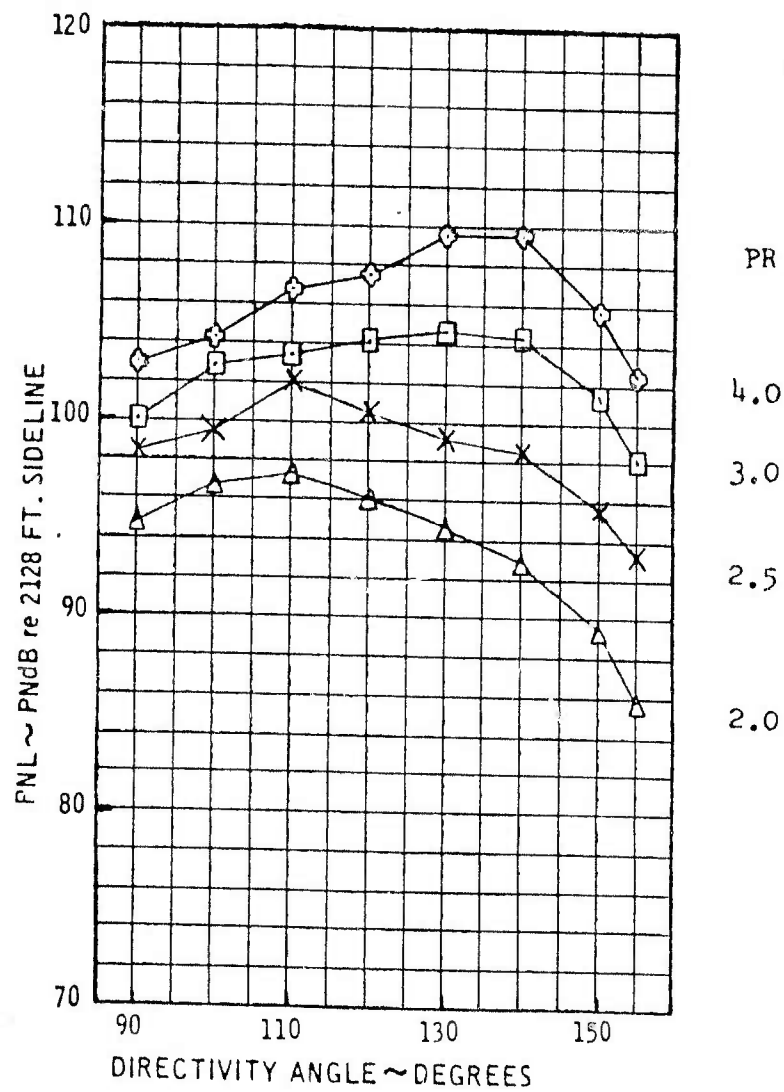


3TT-2.75AR-CPA-ET/RC



PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-2.75AR-CPA-ET/RC



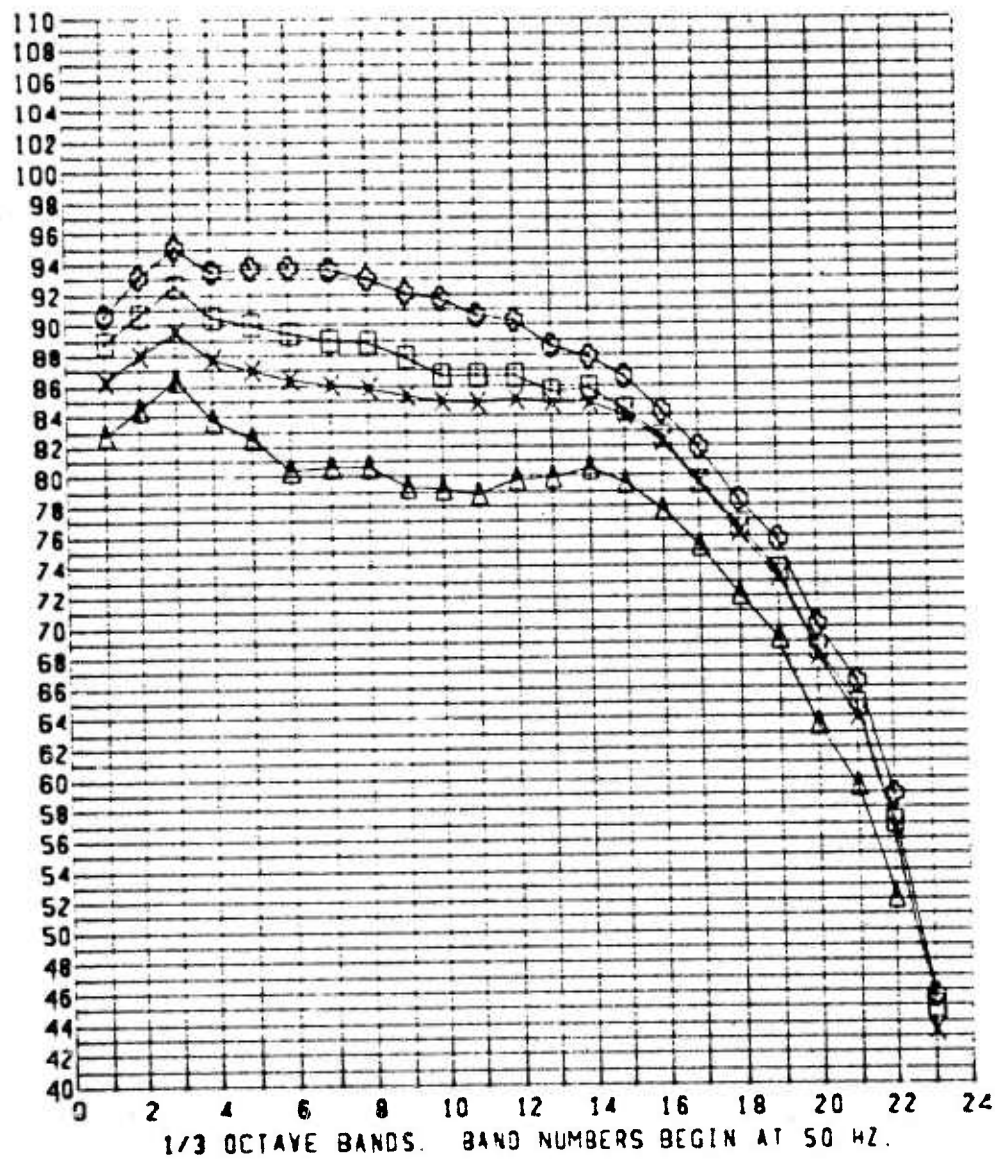
RUN 181
 $T_T = 1150^\circ \text{ F}$ $A_8 = 6.05 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



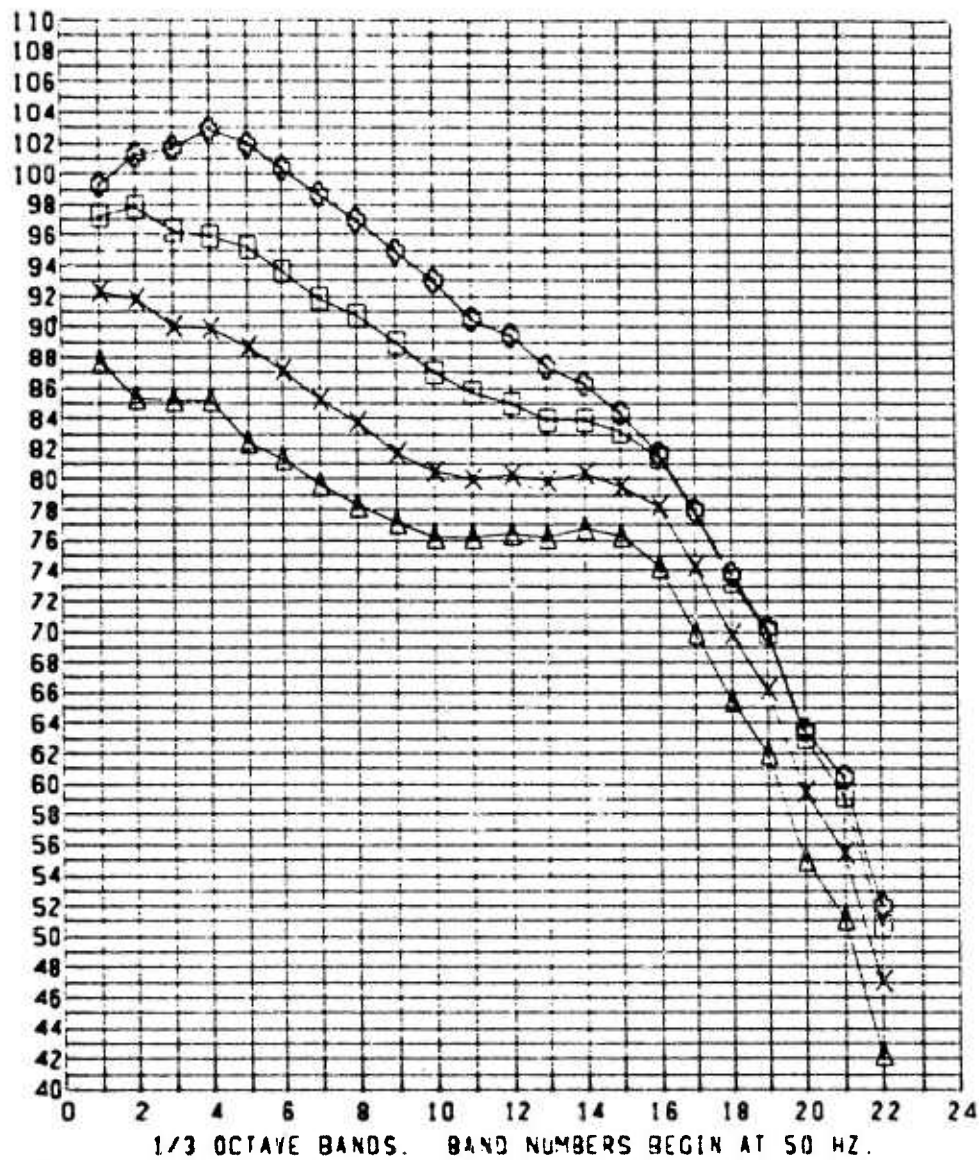
Tt = 1150°F A8 = 6.05 FT² RUN: 181
 PR = Δ 2.0, X 2.5, \square 3.0, + 4.0

NOZZLE: 37T-2.75AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



TT = 1150°F A8 = 6.05 FT² RUN: 181

PR = Δ 2.0, X 2.5, □ 3.0, + 4.0

NOZZLE: 37T-2.75AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
 re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-2.75AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 17, 1973

P_{AMB} = 29.73 in Hg **T_{AMB}** = 44°F **R.H.** = 88%

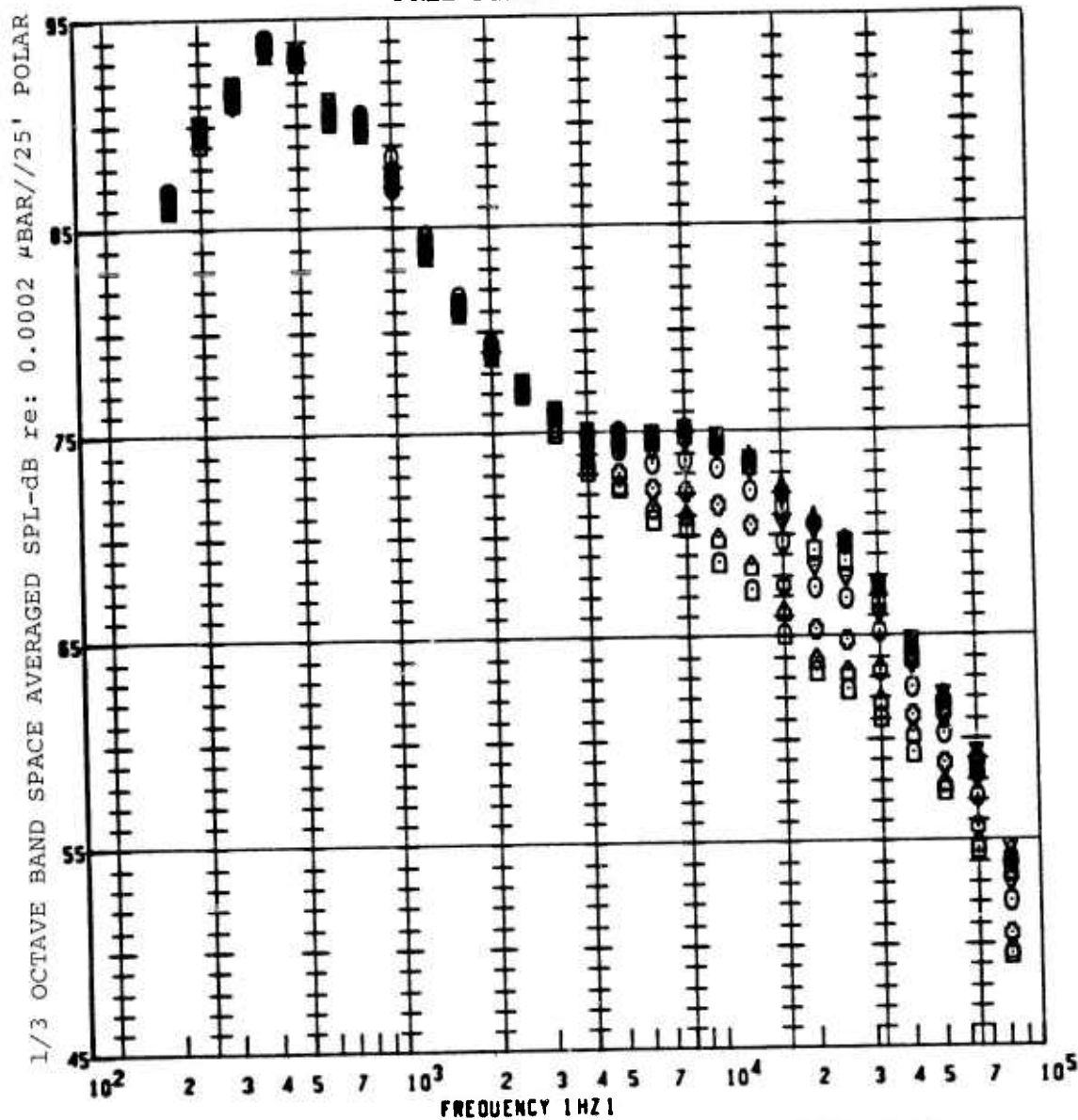
NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
50	0.0 x/D	9.0 in.		
51	0.25	9.0		
52	0.50	10.0		
53	0.75	9.5		
54	1.00	10.5		
55	1.25	9.5		
56	1.50	10.0		
57	1.75	10.0		
58	2.0	10.5		
59	2.25	10.5		
60	2.50	11.0		
61	2.50	11.0		
62	3.0	11.5		
63	3.5	12.0		
64	4.0	12.5		
65	5.0	13.0		
66	6.0	14.0		
67	8.0	16.0		
68	10.0	18.0		
69	12.0	20.0		
70	14.0	21.5		
71	16.0	23.5		

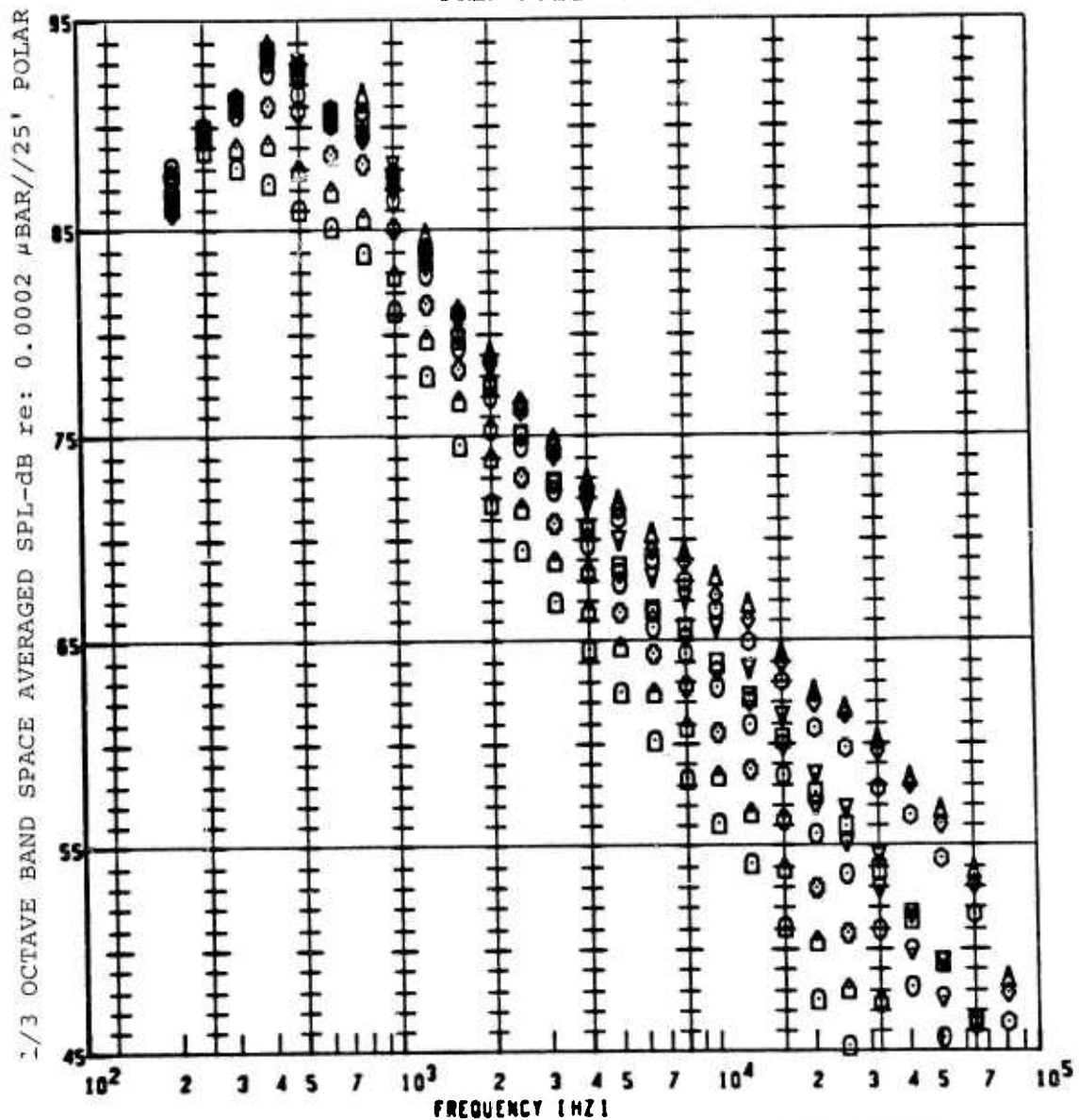
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

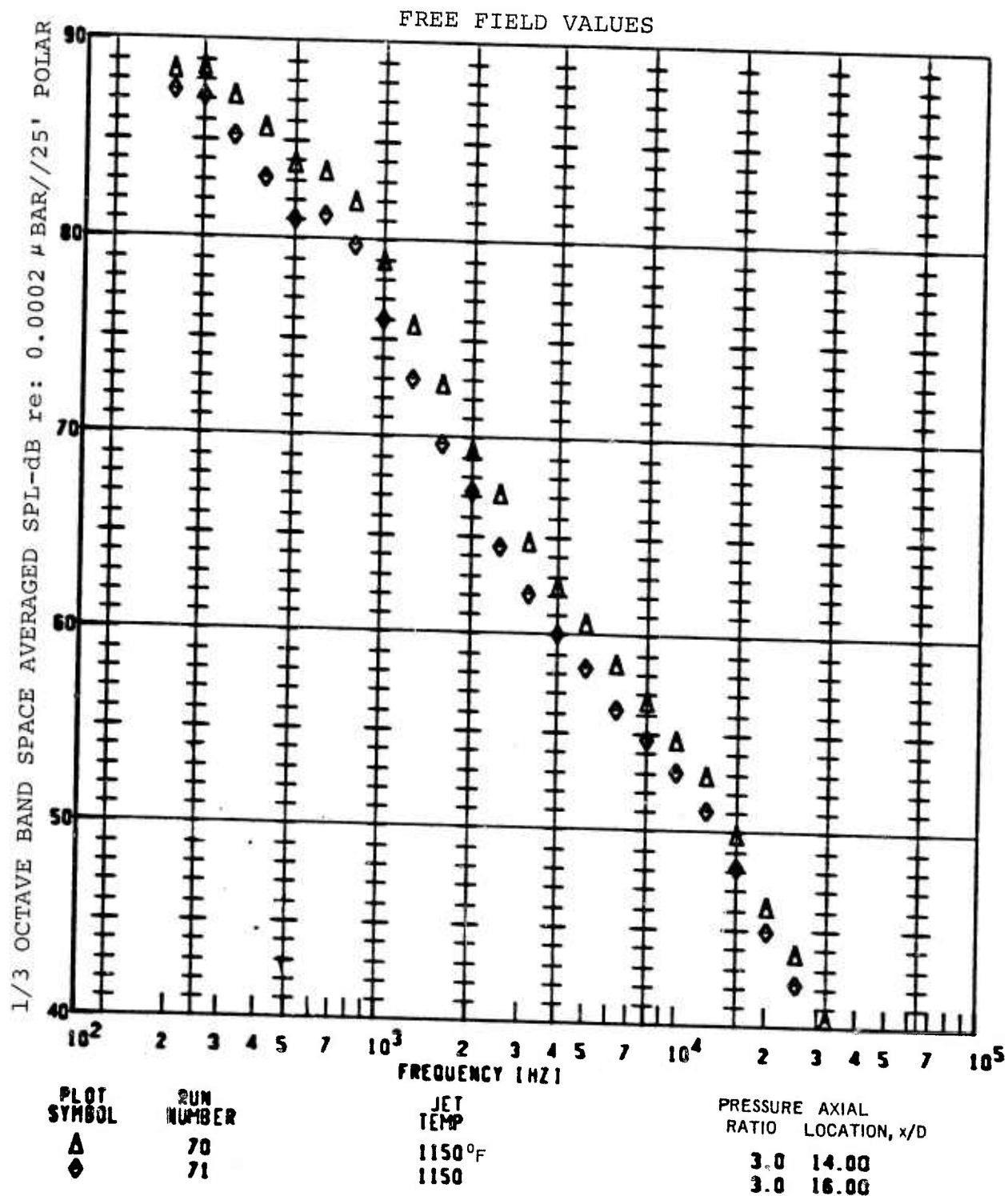


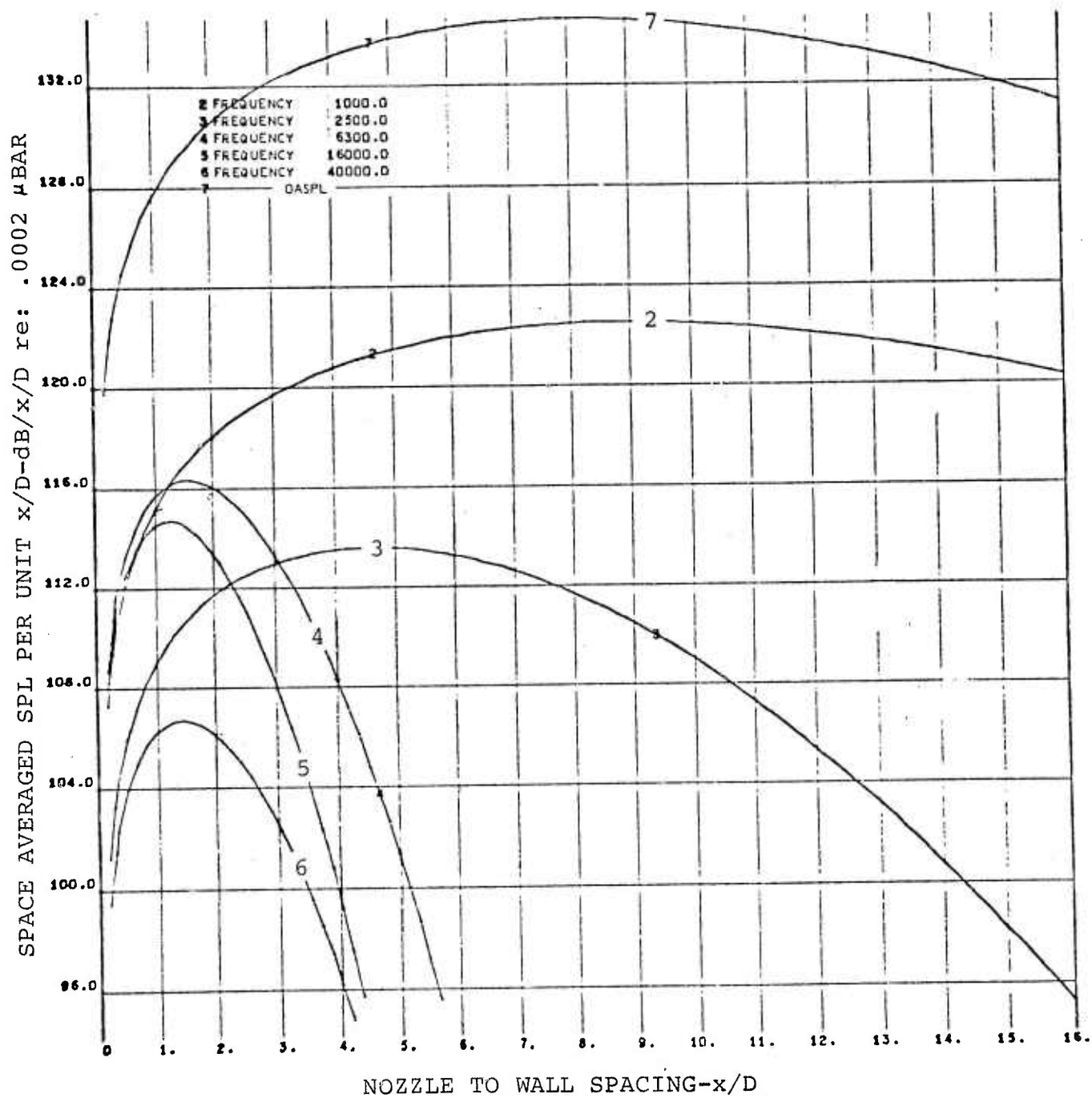
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE AXIAL RATIO	LOCATION, x/D
Δ	50	1150°F	3.000	0.00
◊	51	1150	3.000	0.25
○	52	1150	3.000	0.50
▽	53	1150	3.000	0.75
◻	54	1150	3.000	1.00
◊	55	1150	3.000	1.25
○	56	1150	3.000	1.50
◊	57	1150	3.000	1.75
◻	58	1150	3.000	2.00
◻	59	1150	3.000	2.25

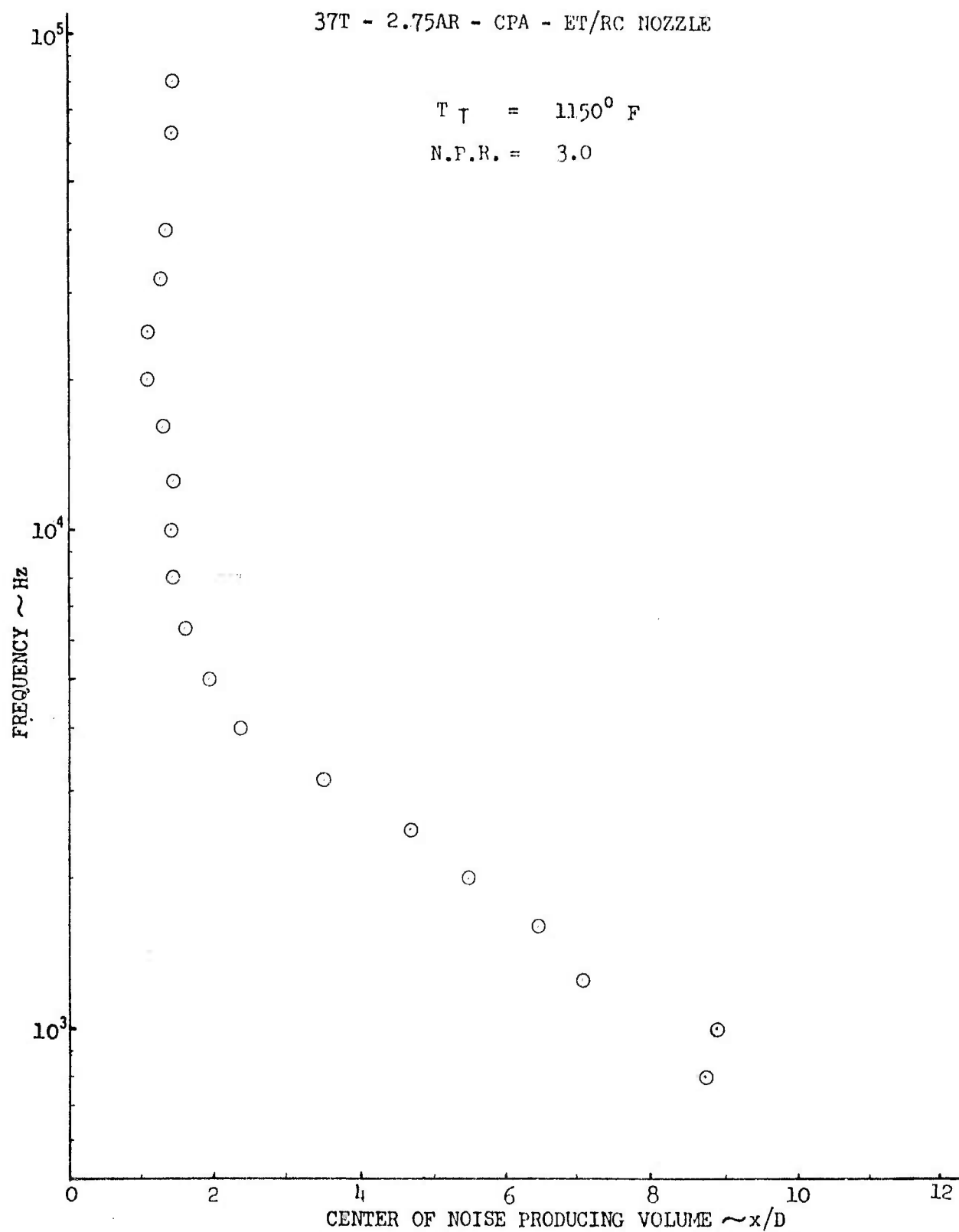
FREE FIELD VALUES

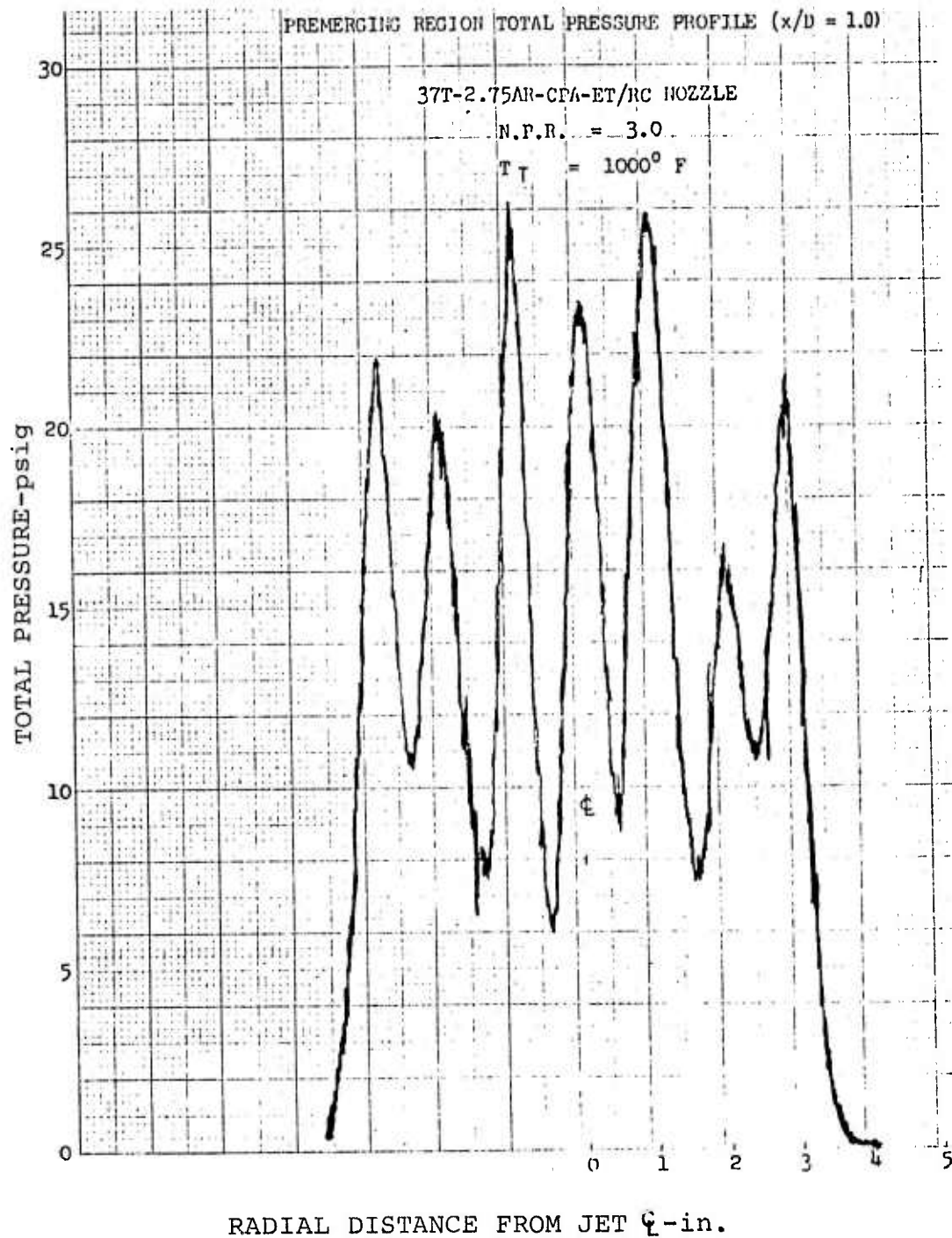


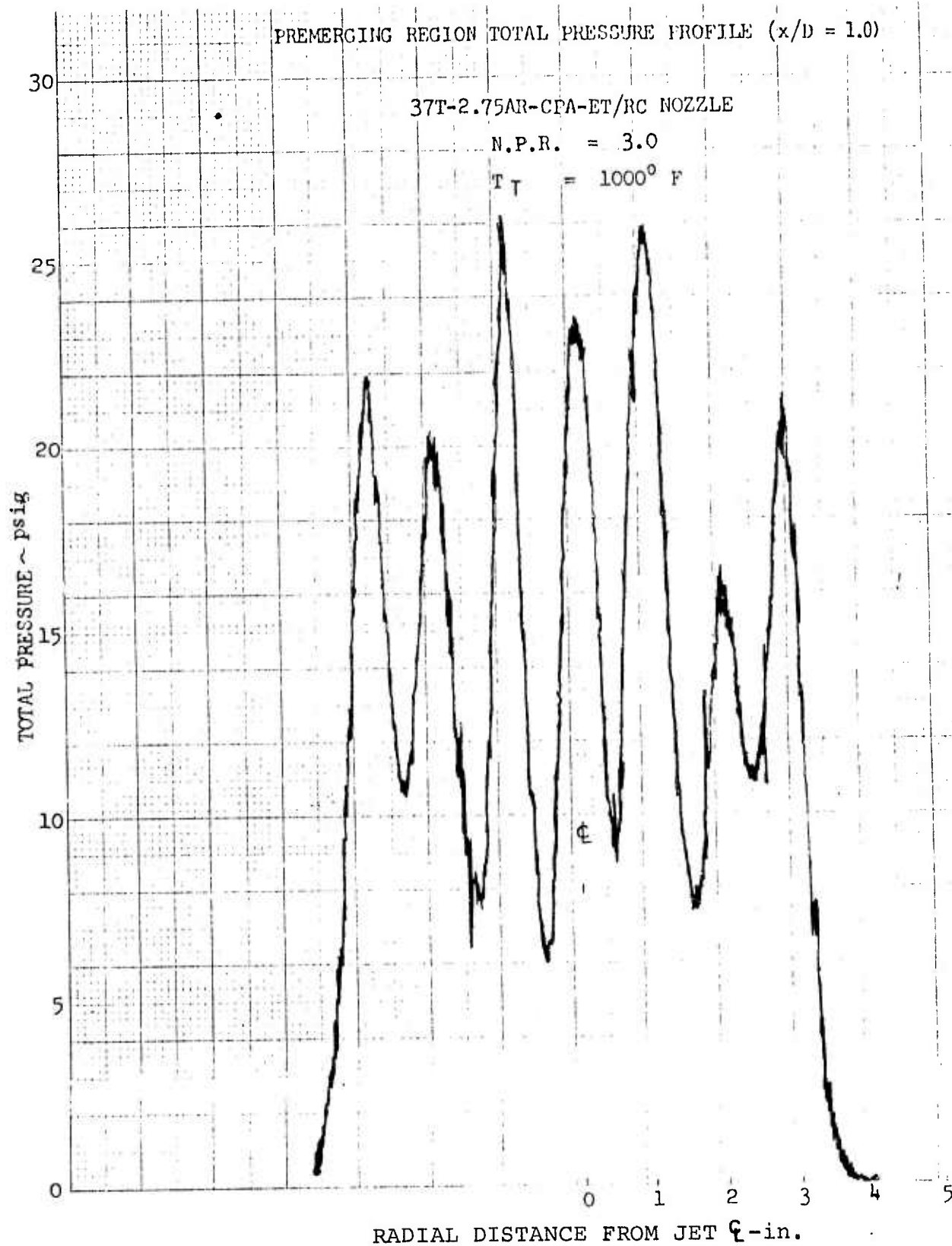
PLT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	60	1150°F	3.000	2.50
◆	61	1150	3.000	2.50
○	62	1150	3.000	3.00
▽	63	1150	3.000	3.50
□	64	1150	3.000	4.00
◇	65	1150	3.000	5.00
○	66	1150	3.000	6.00
○	67	1150	3.000	8.00
△	68	1150	3.000	10.00
□	69	1150	3.000	12.00

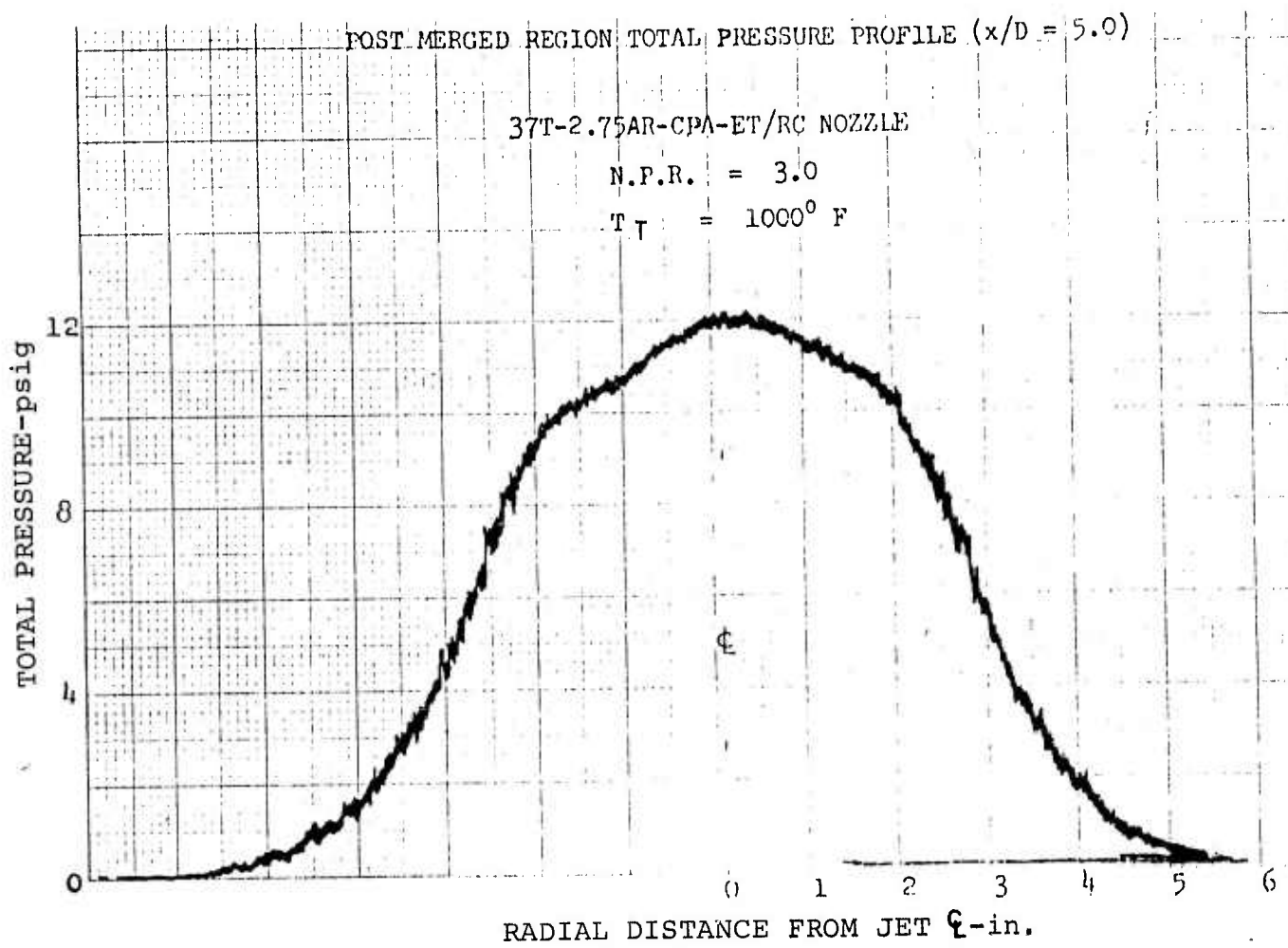


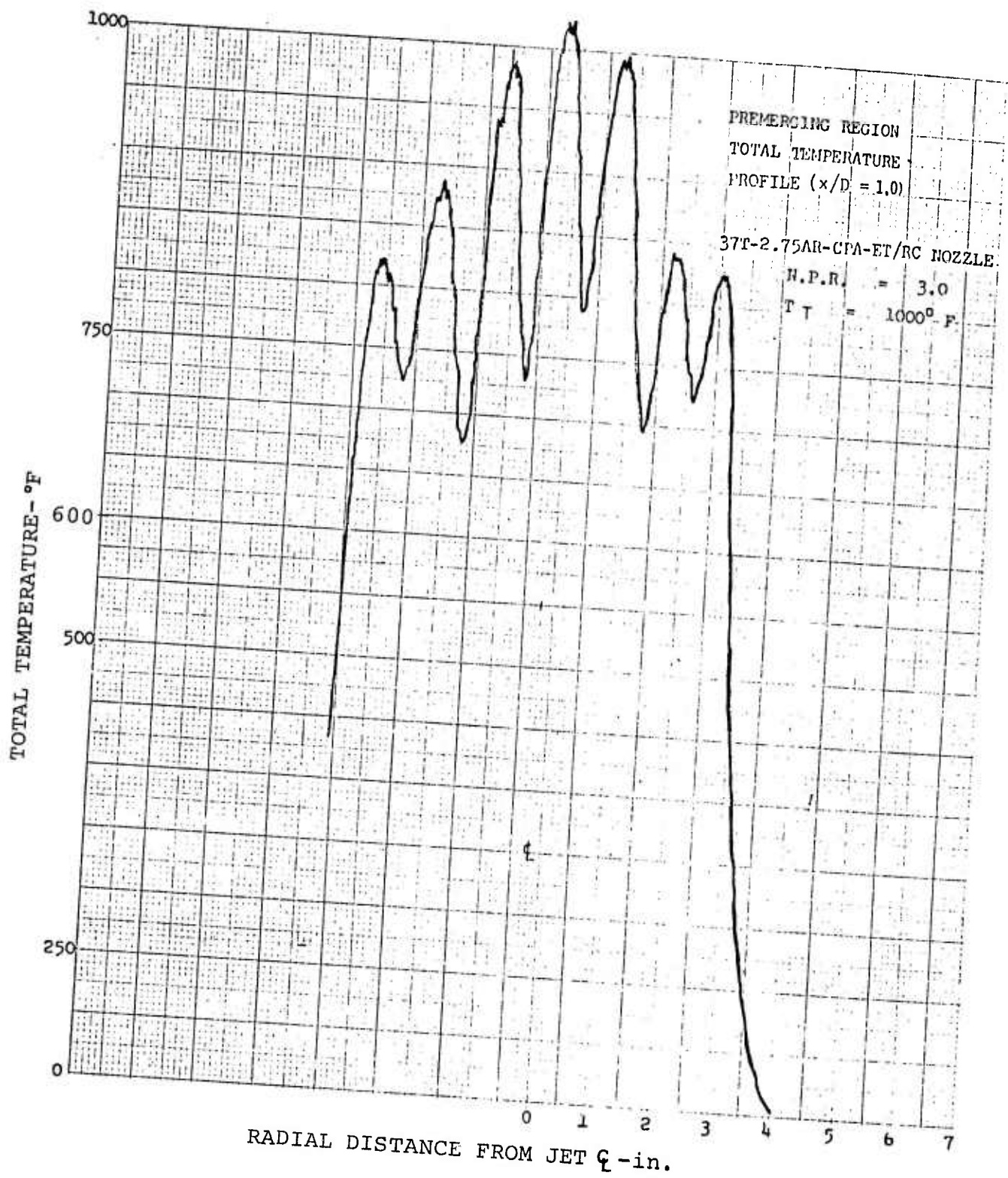


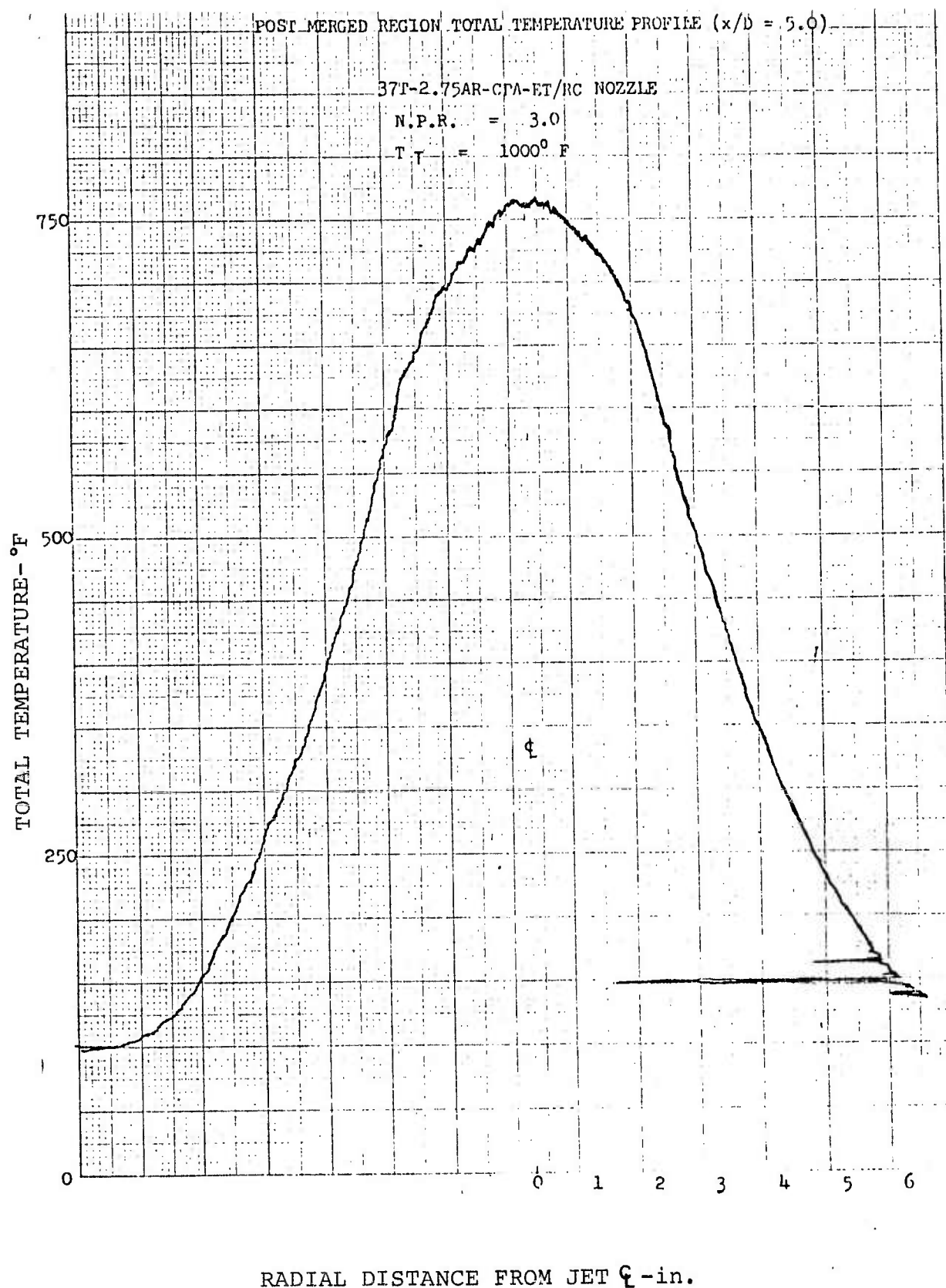


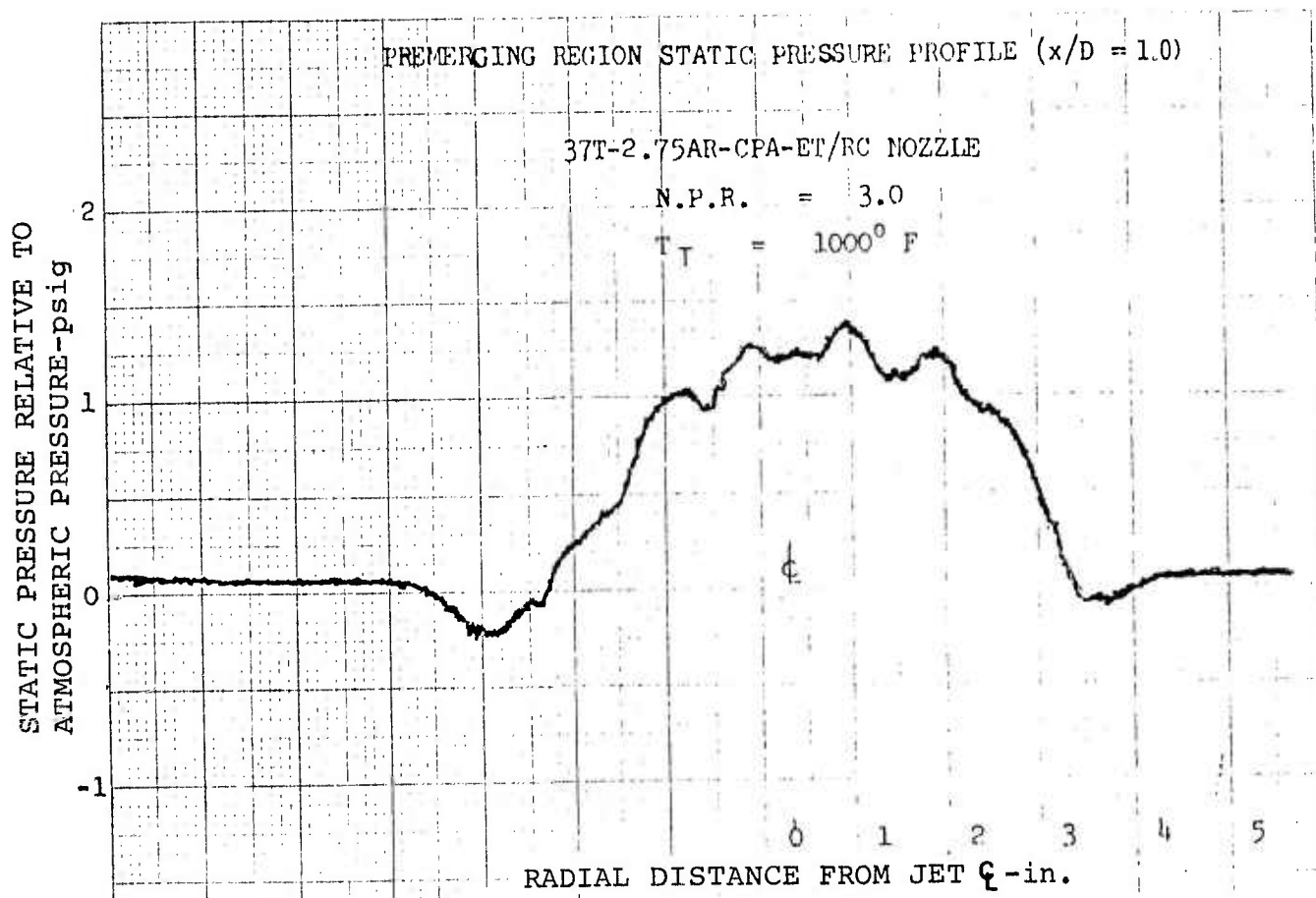


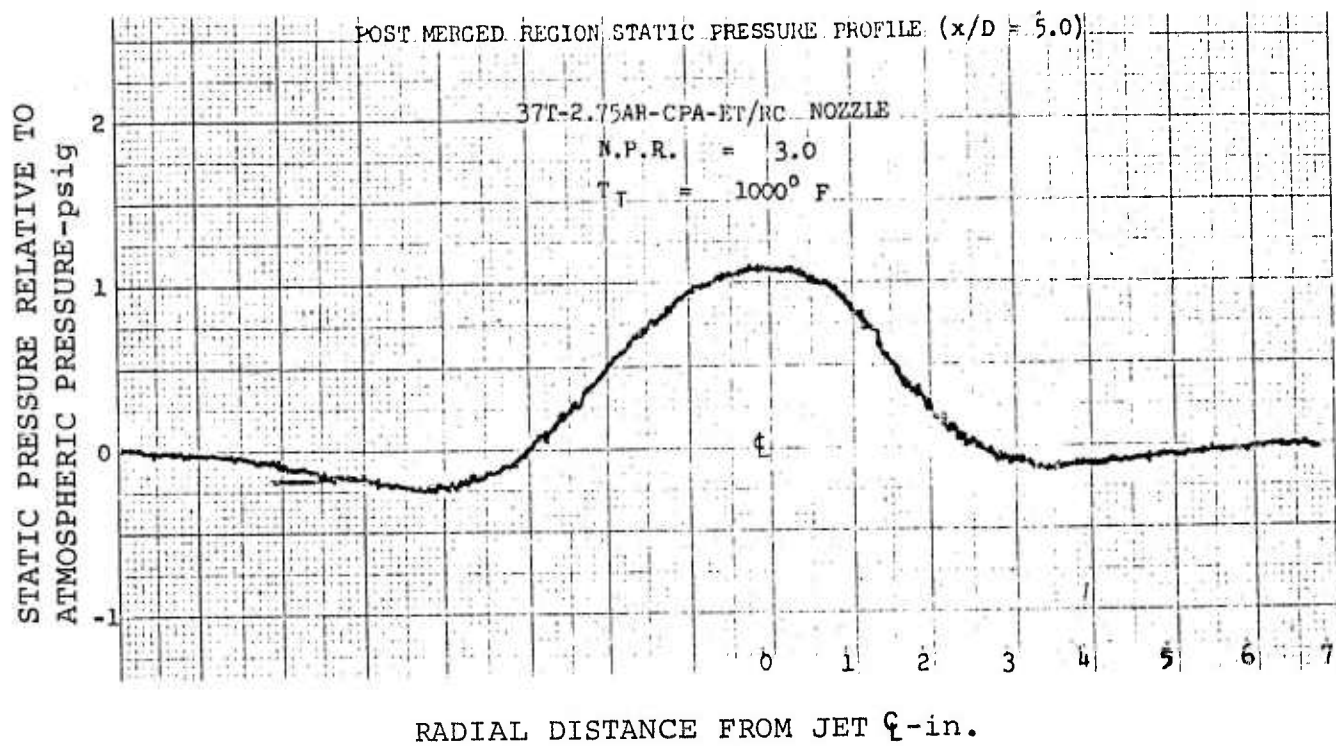


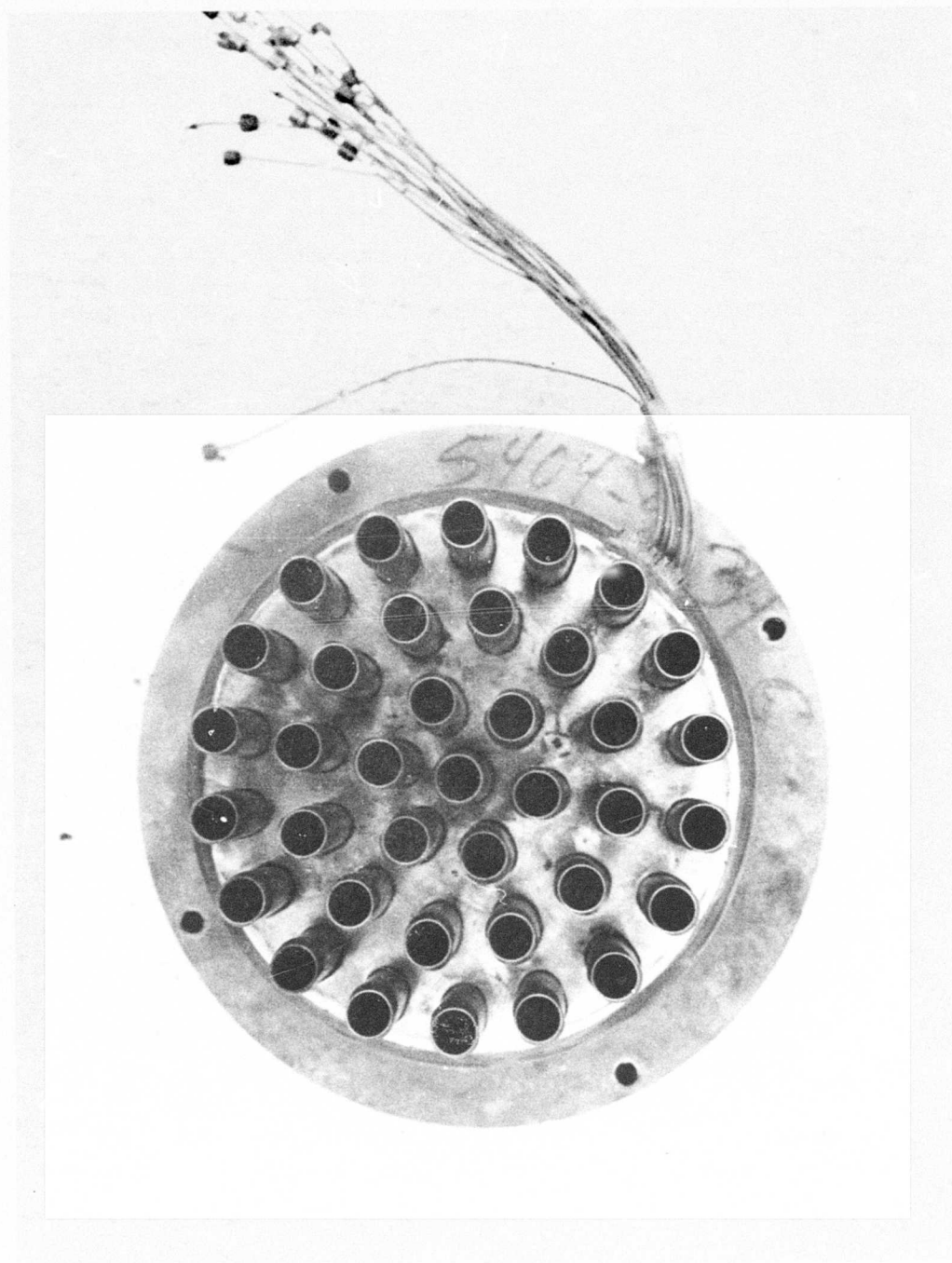












37T-4.5AR-CPA-ET/RC NOZZLE

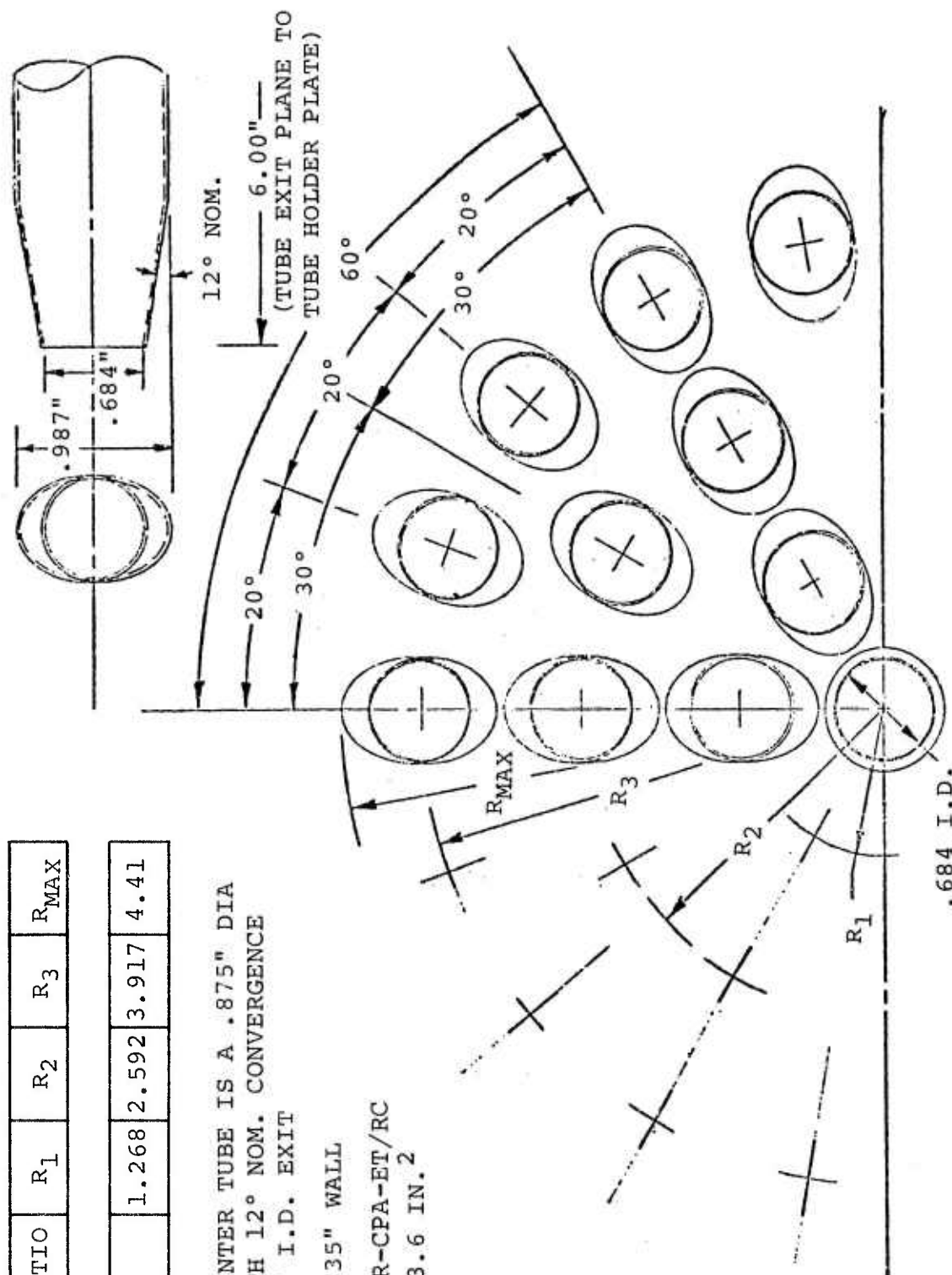
AREA RATIO	R ₁	R ₂	R ₃	R _{MAX}
4.5	1.268	2.592	3.917	4.41

NOTE: CENTER TUBE IS A .875" DIA
TUBE WITH 12° NOM. CONVERGENCE
TO .684" I.D. EXIT

MAT'L-.035" WALL

37T-4.5AR-CPA-ET/RC

$A_8 = 13.6 \text{ IN.}^2$



37 TUBE - AREA RATIO 4.5 ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-4.5AR-CPA-ET/RC

FACILITY: HNTF

DATE: 10-19-73

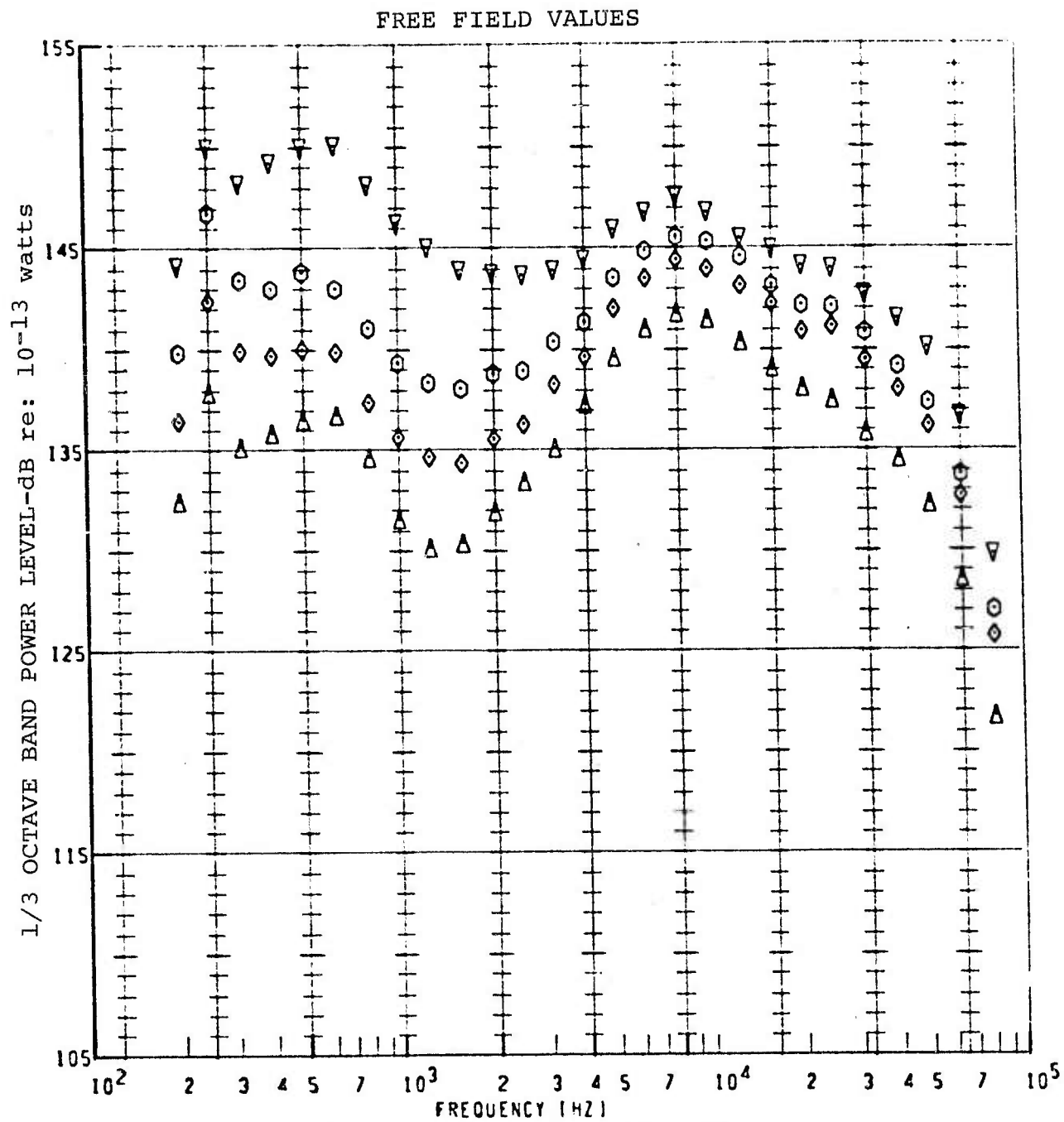
T_{AMB} = 65°F

R.H. = 62%

SCALE MODEL $A_8 = 13.6 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
190	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

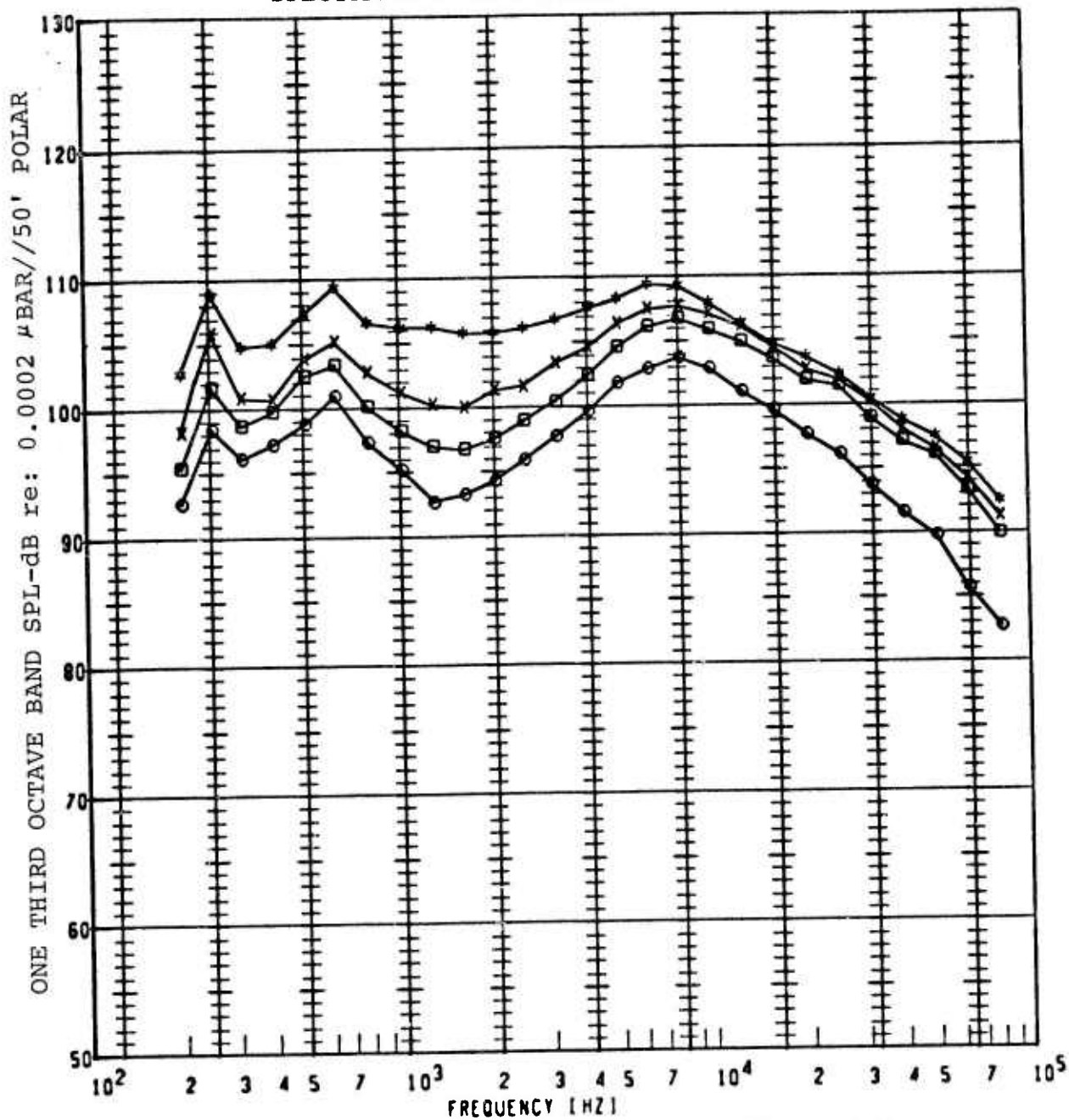
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



NOZZLE: 37T-4.5AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

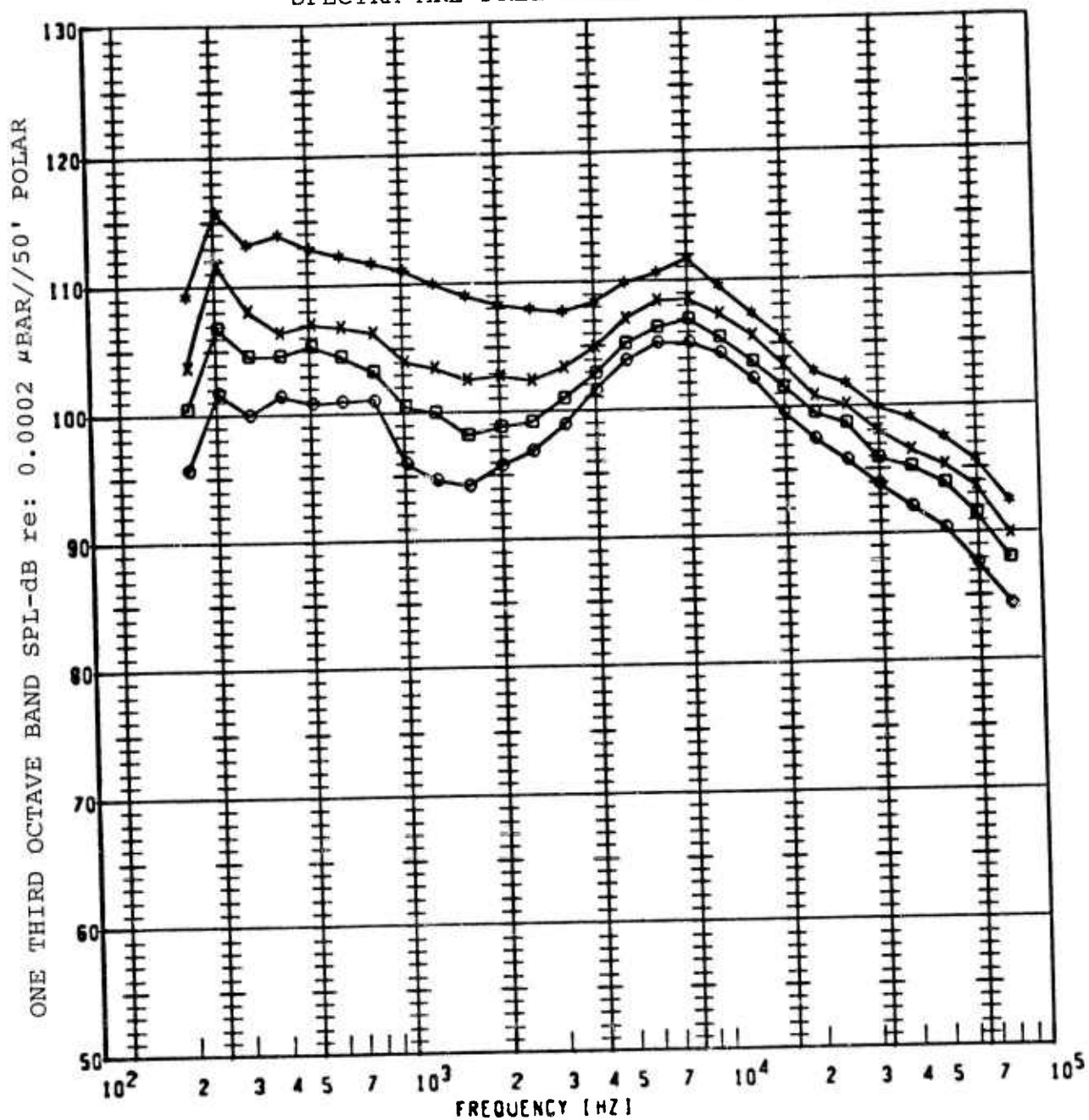


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (OBL)
○	190G	1150°F	2.000	110°	50FP	112.7
◻	190G	1150	2.500		50FP	116.0
x	190G	1150	3.000		50FP	117.7
*	190G	1150	4.000		50FP	120.4

NOZZLE: 37T-4.5AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

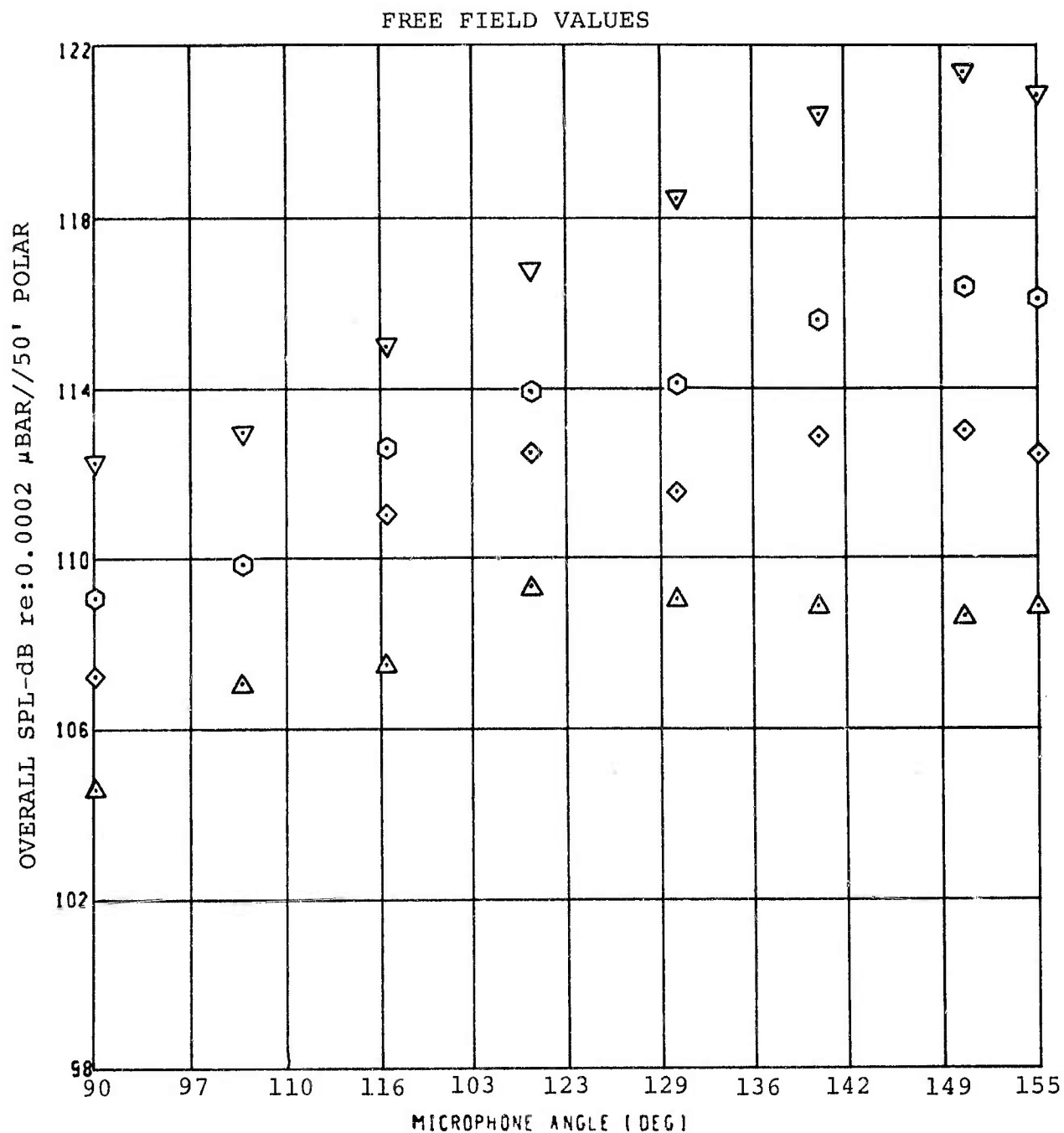
SPECTRA ARE FREE FIELD + 6dB

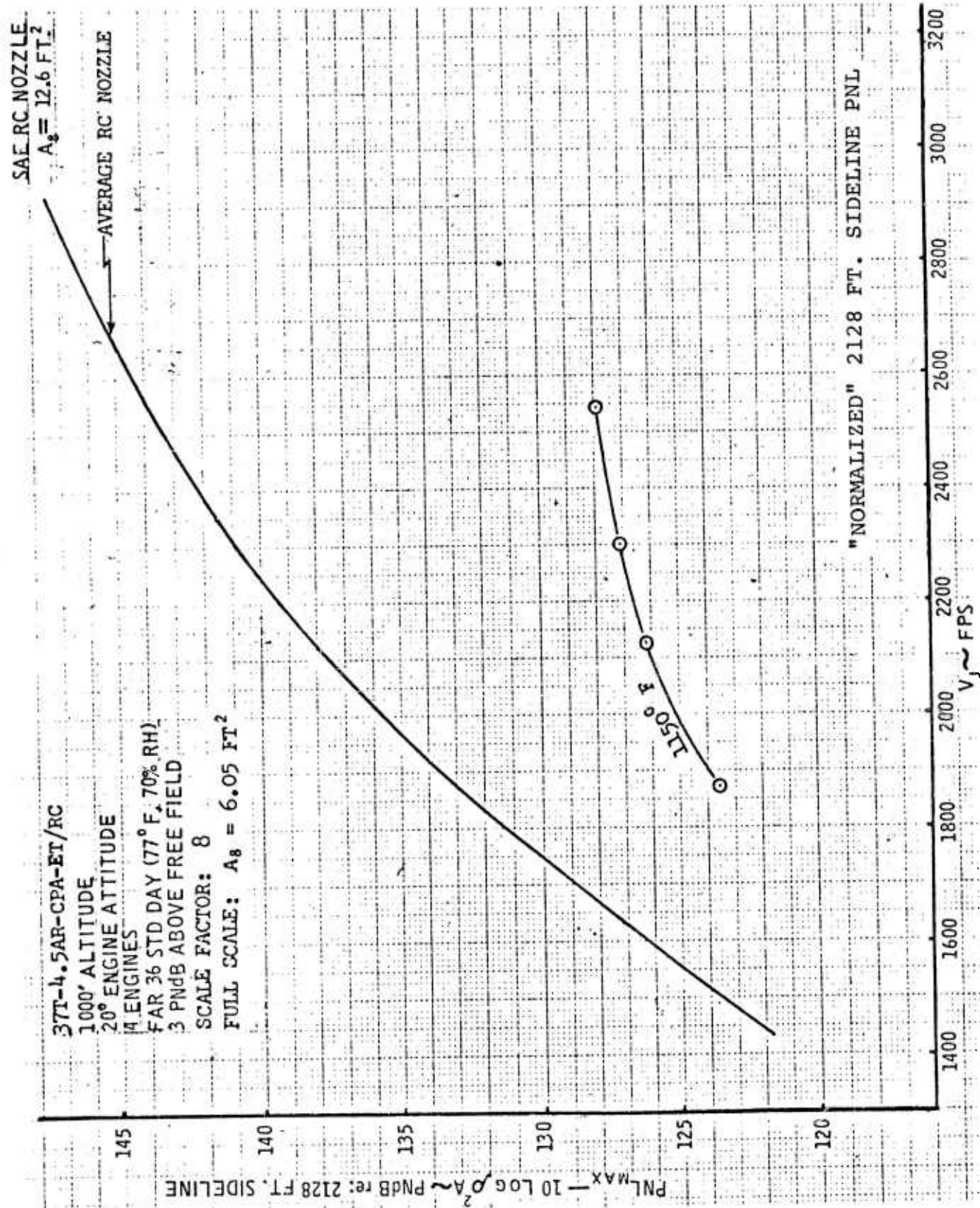


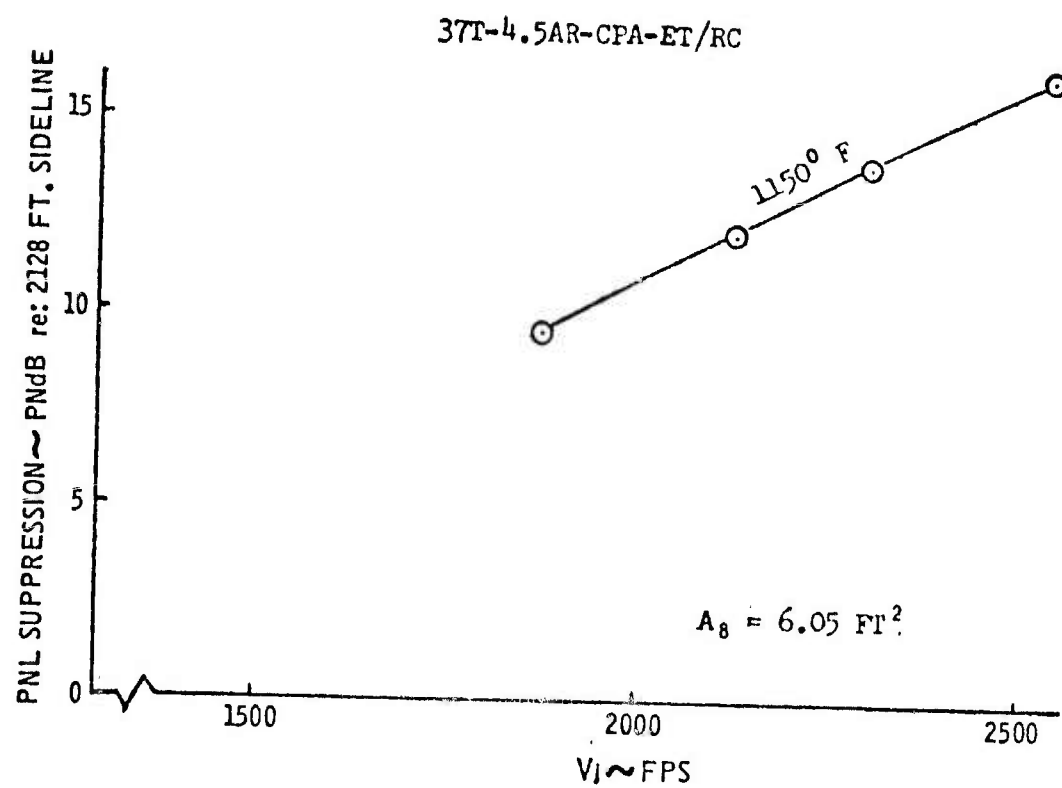
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OSPL (DB)
○	190G	1150°F	2.000	130°	50FP	114.4
□	190G	1150	2.500	↓	50FP	117.0
x	190G	1150	3.000	↓	50FP	119.6
*	190G	1150	4.000	↓	50FP	124.1

NOZZLE: 37T-4.5AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

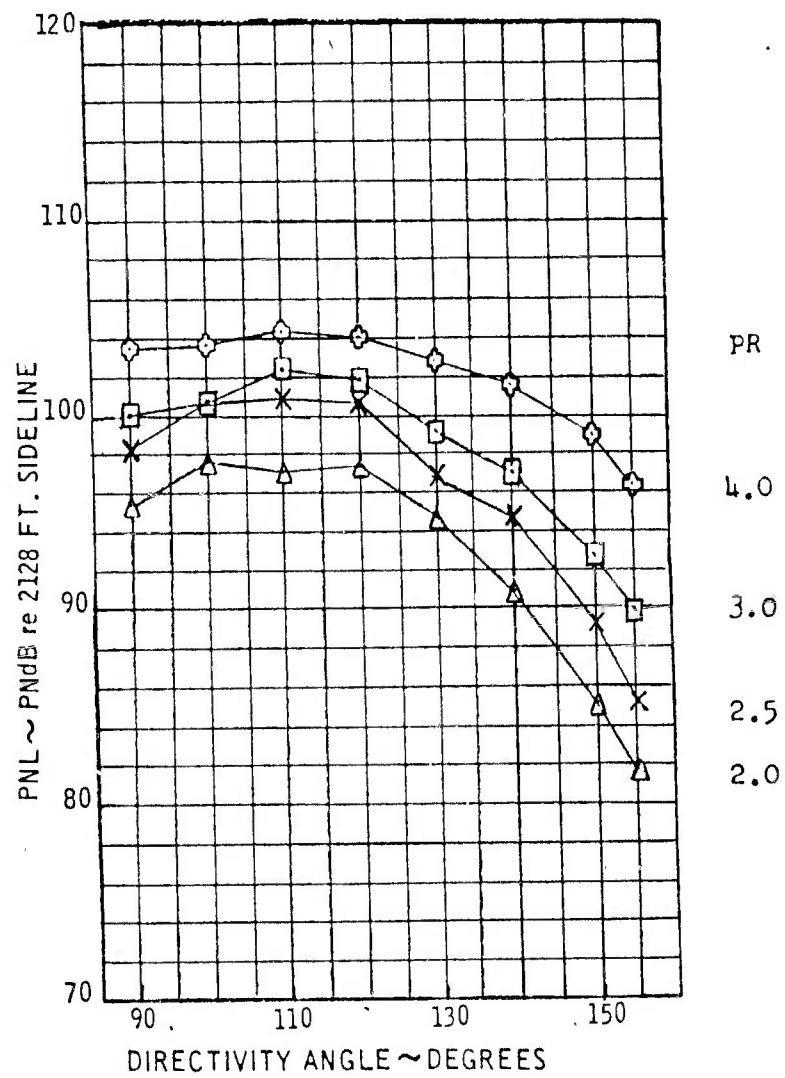






PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-4.5AR-CPA-ET/RC

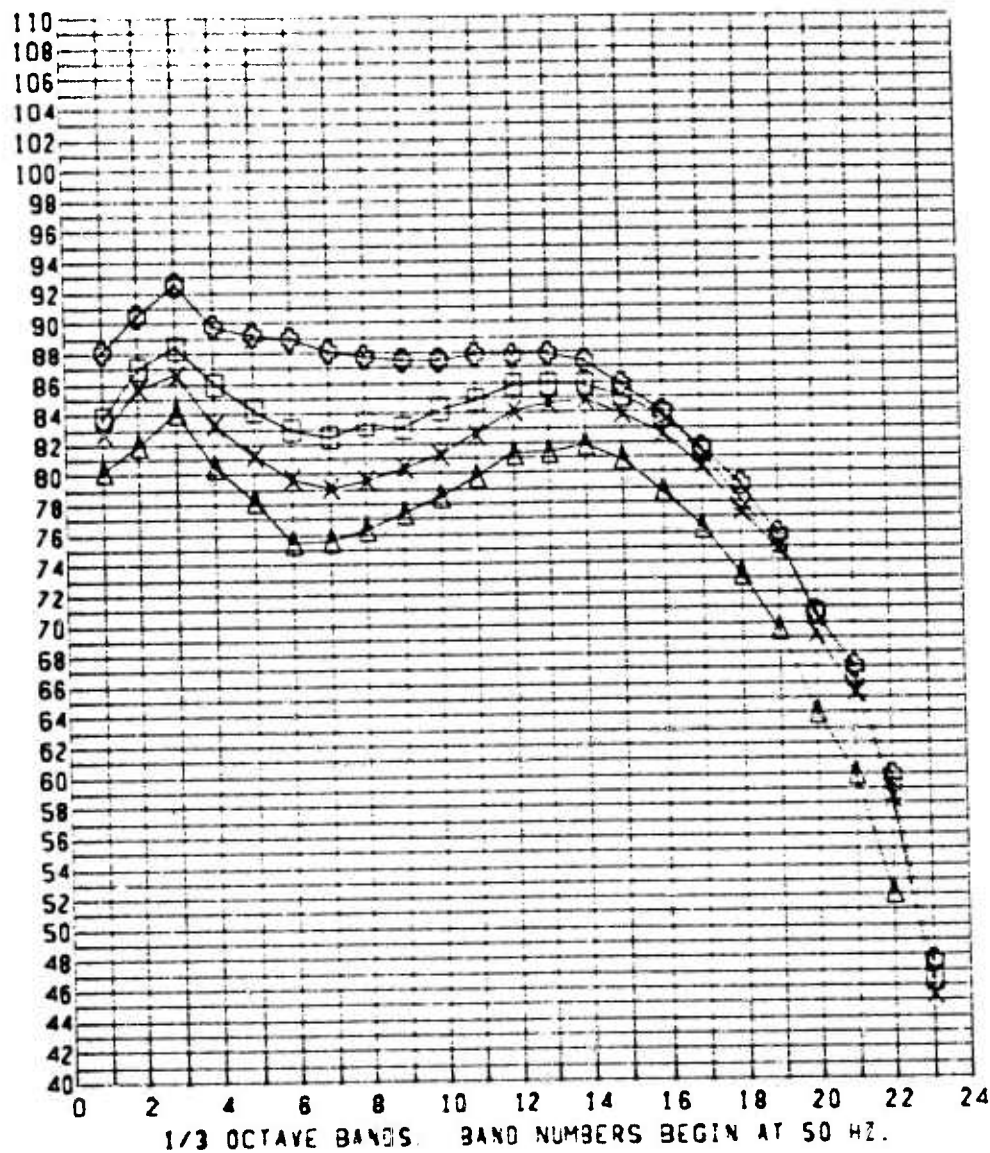


RUN 190
 $T_T = 1150^{\circ} F$ $A_8 = 6.05 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



Tt = 1150°F A8 = 6.05 FT² RUN: 190
 PR = Δ 2.0, X 2.5, \square 3.0, + 4.0

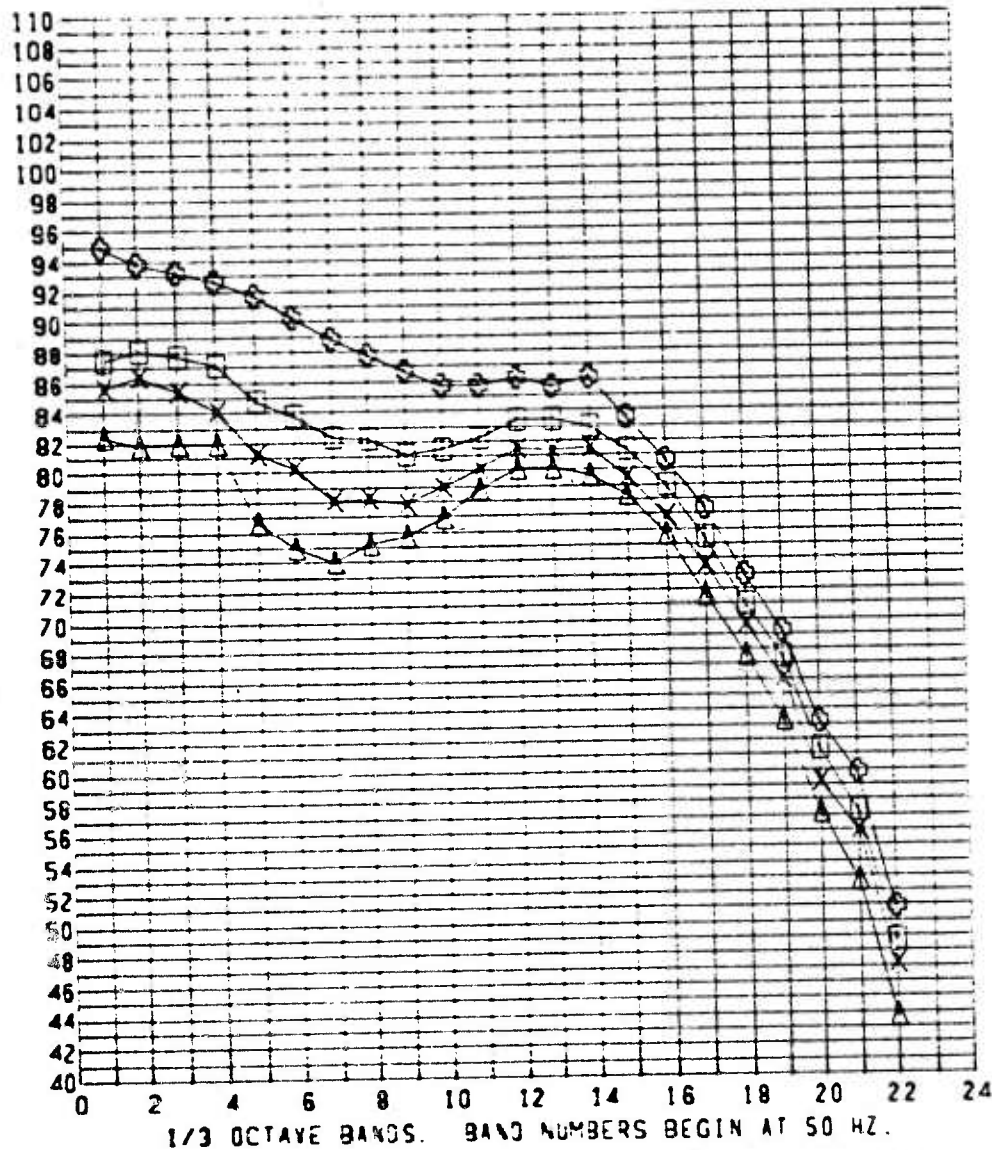
NOZZLE: 37T-4.5AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



TT = 1150°F A8 = 6.05 FT² RUN: 190
PR = Δ 2.0, X 2.5, □ 3.0, + 4.0

NOZZLE: 37T-4.5AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-4.5AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 16, 1973

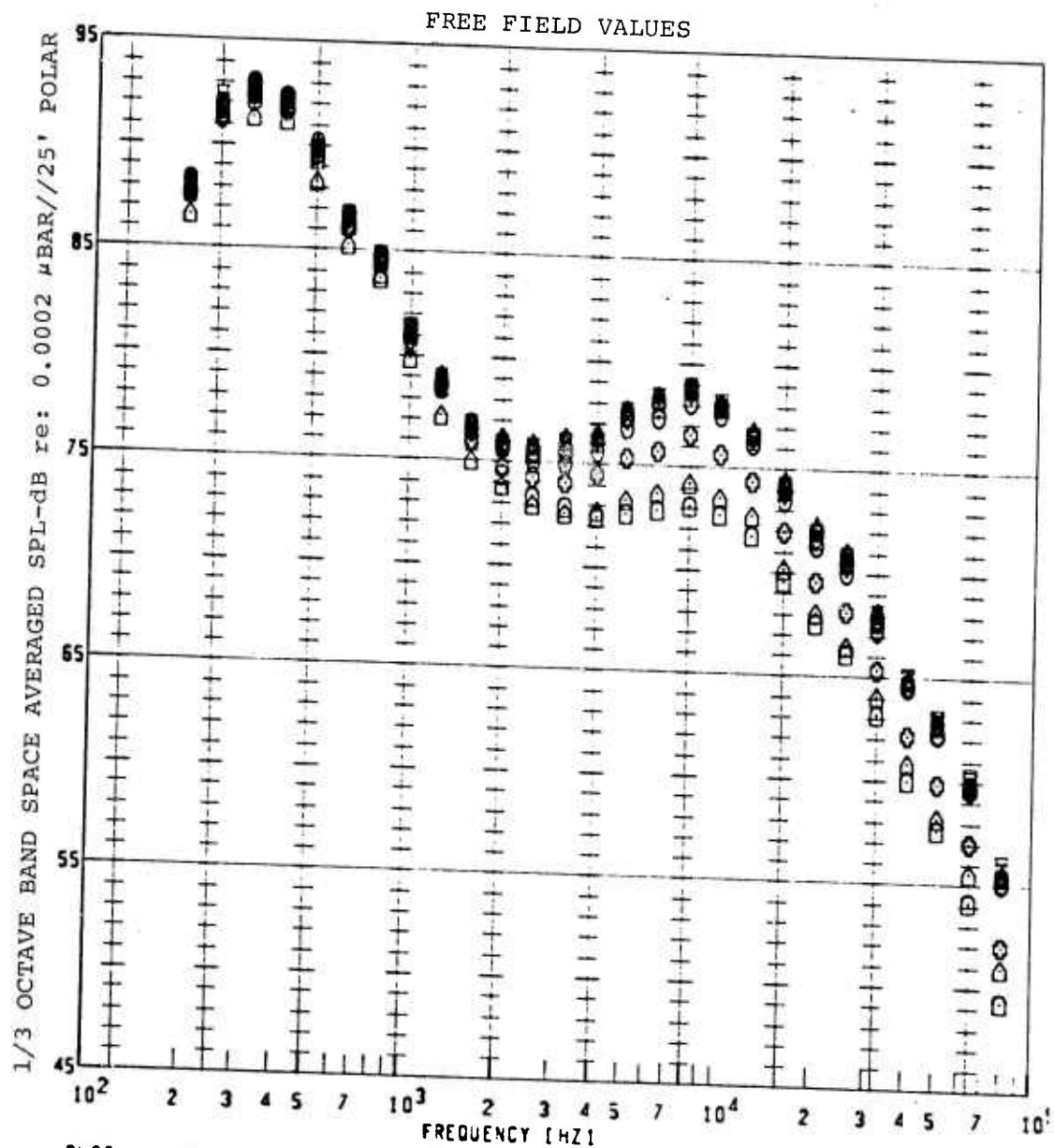
P_{AMB} = 29.34 in Hg **T_{AMB}** = 46°F **R.H.** = 91%

NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

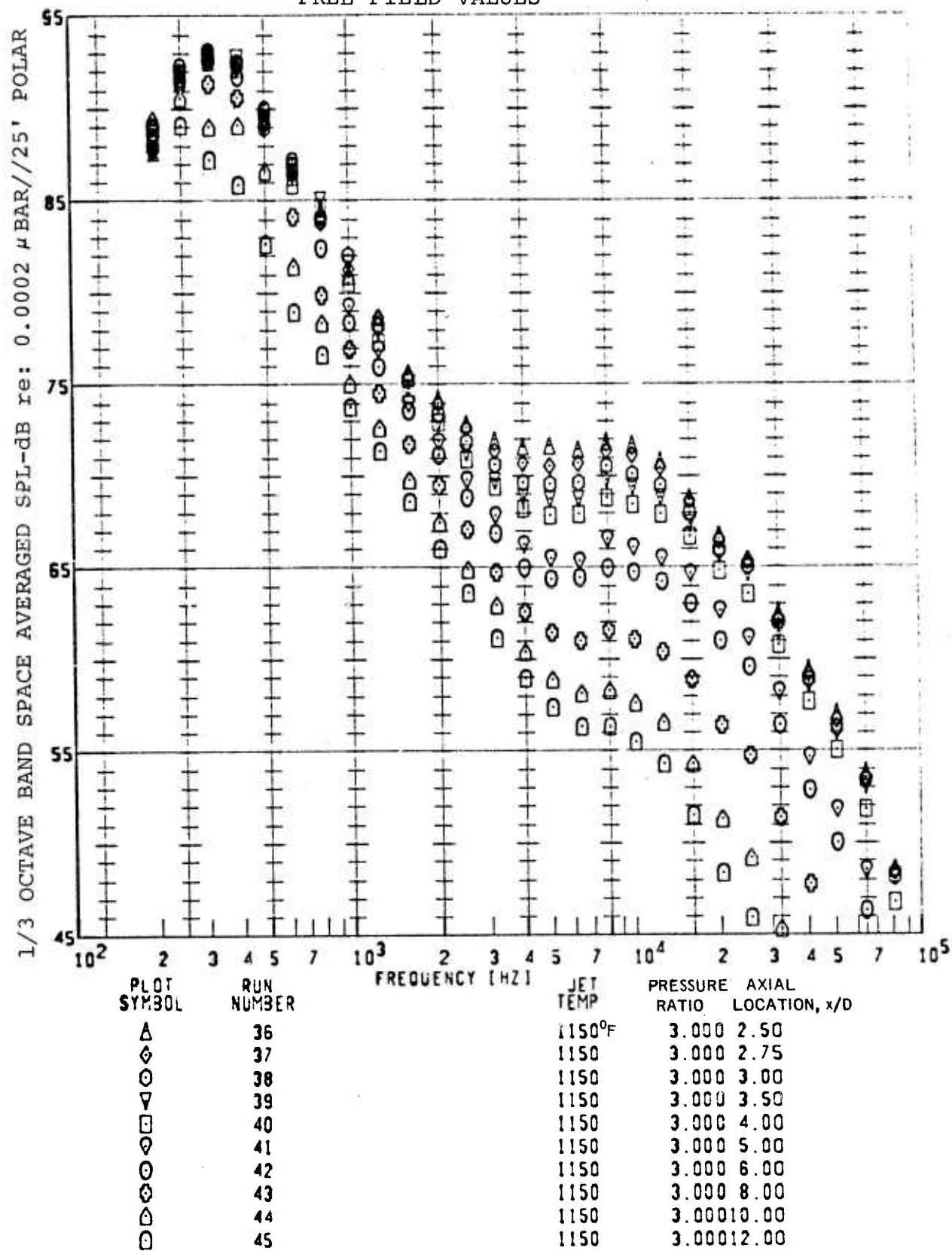
<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
26	0.0 x/D	11.0 in.		
27	0.25	12.0		
28	0.50	12.5		
29	0.75	12.5		
30	1.00	15.0		
31	1.25	13.0		
32	1.50	12.0		
33	1.75	12.5		
34	2.00	12.5		
35	2.25	13.0		
36	2.50	13.0		
37	2.75	13.5		
38	3.0	14.5		
39	3.5	14.0		
40	4.0	14.5		
41	5.0	16.5		
42	6.0	16.5		
43	8.0	18.0		
44	10.0	20.0		
45	12.0	22.0		
46	14.0	24.0		
47	16.0	24.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

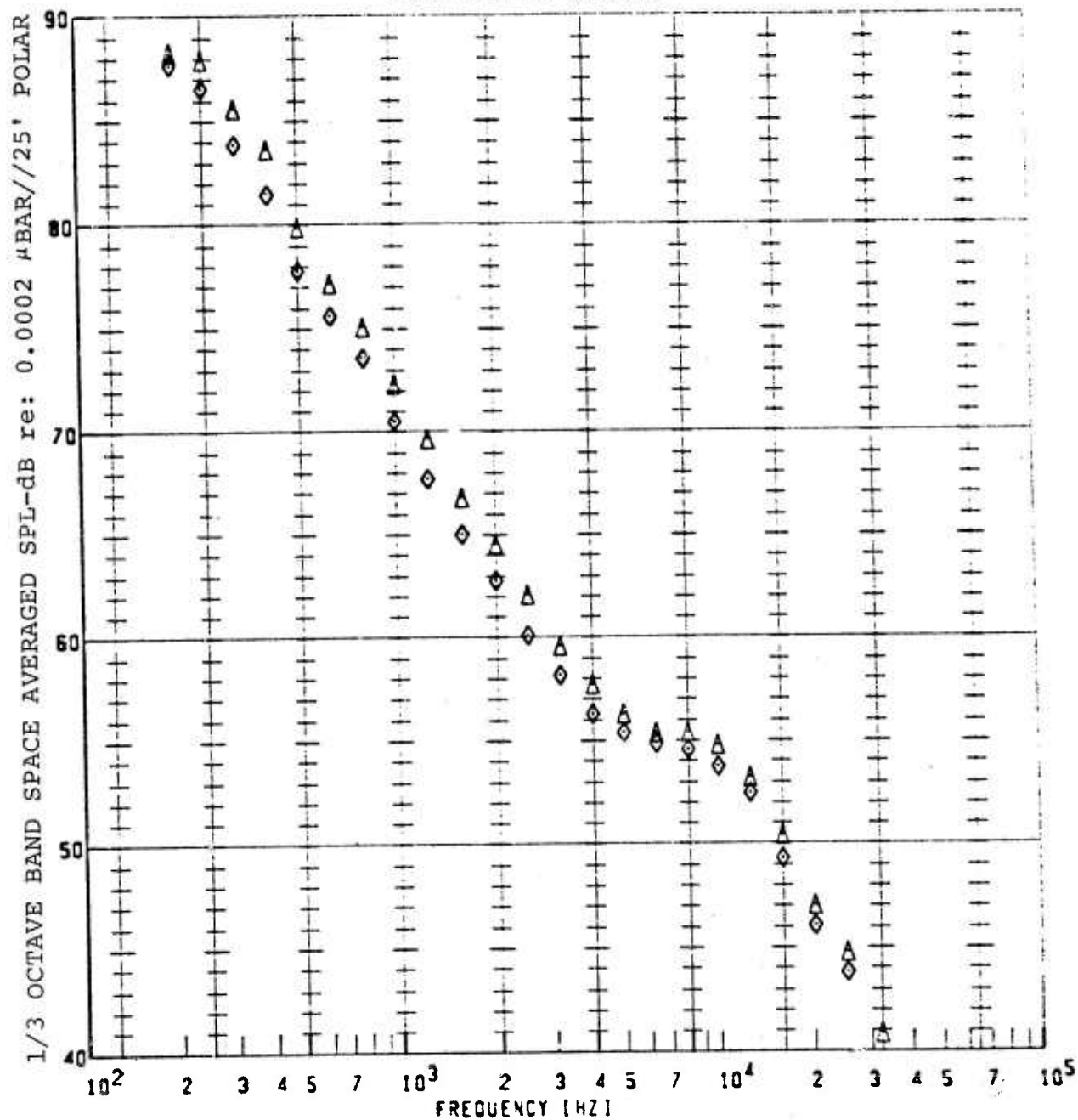


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	26	1150°F	3.0	0.00
◇	27	1150	3.0	0.25
○	28	1150	3.0	0.50
▽	29	1150	3.0	0.75
□	30	1150	3.0	1.00
◇	31	1150	3.0	1.25
○	32	1150	3.0	1.50
◇	33	1150	3.0	1.75
△	34	1150	3.0	2.00
□	35	1150	3.0	2.25

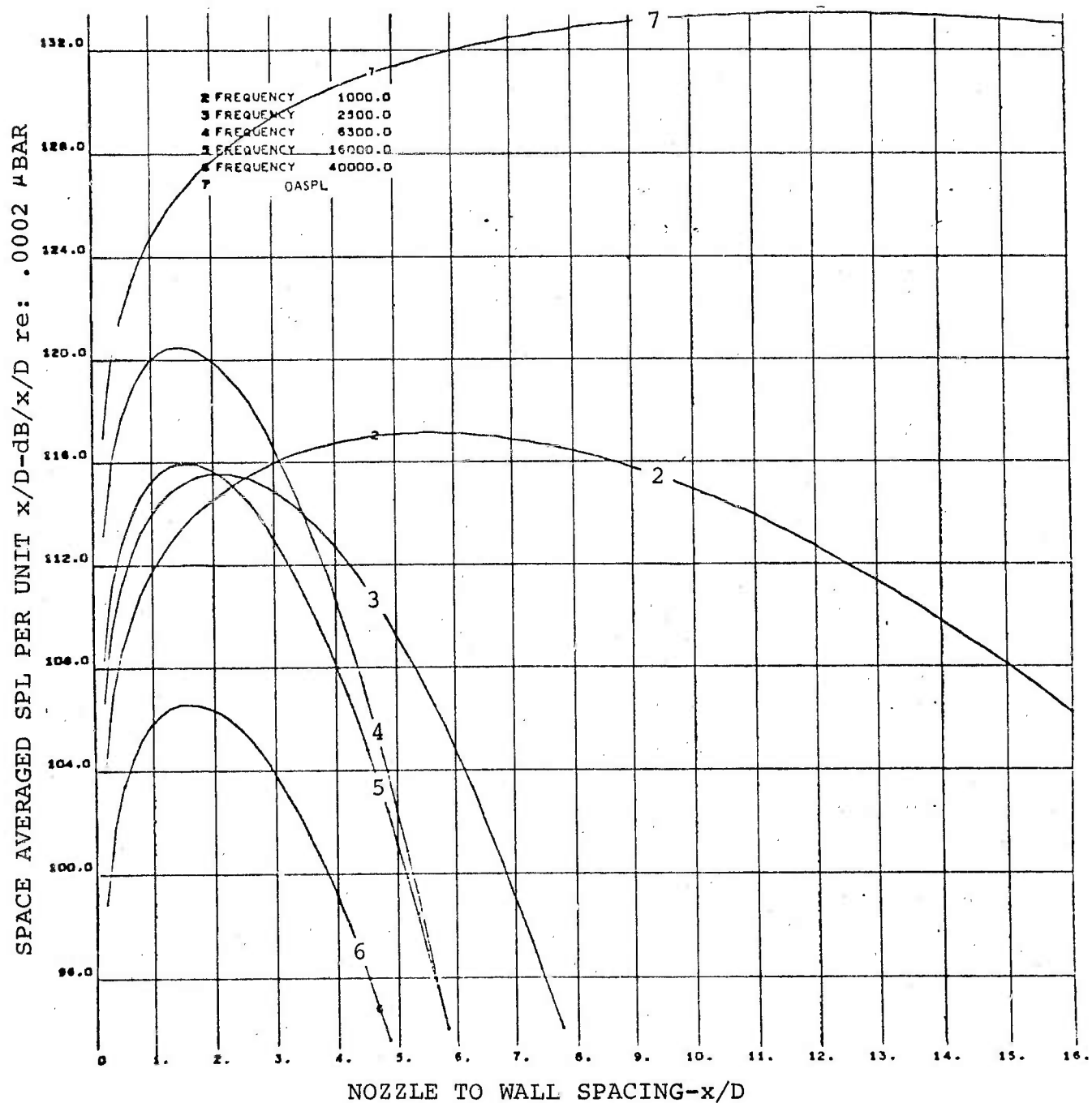
FREE FIELD VALUES

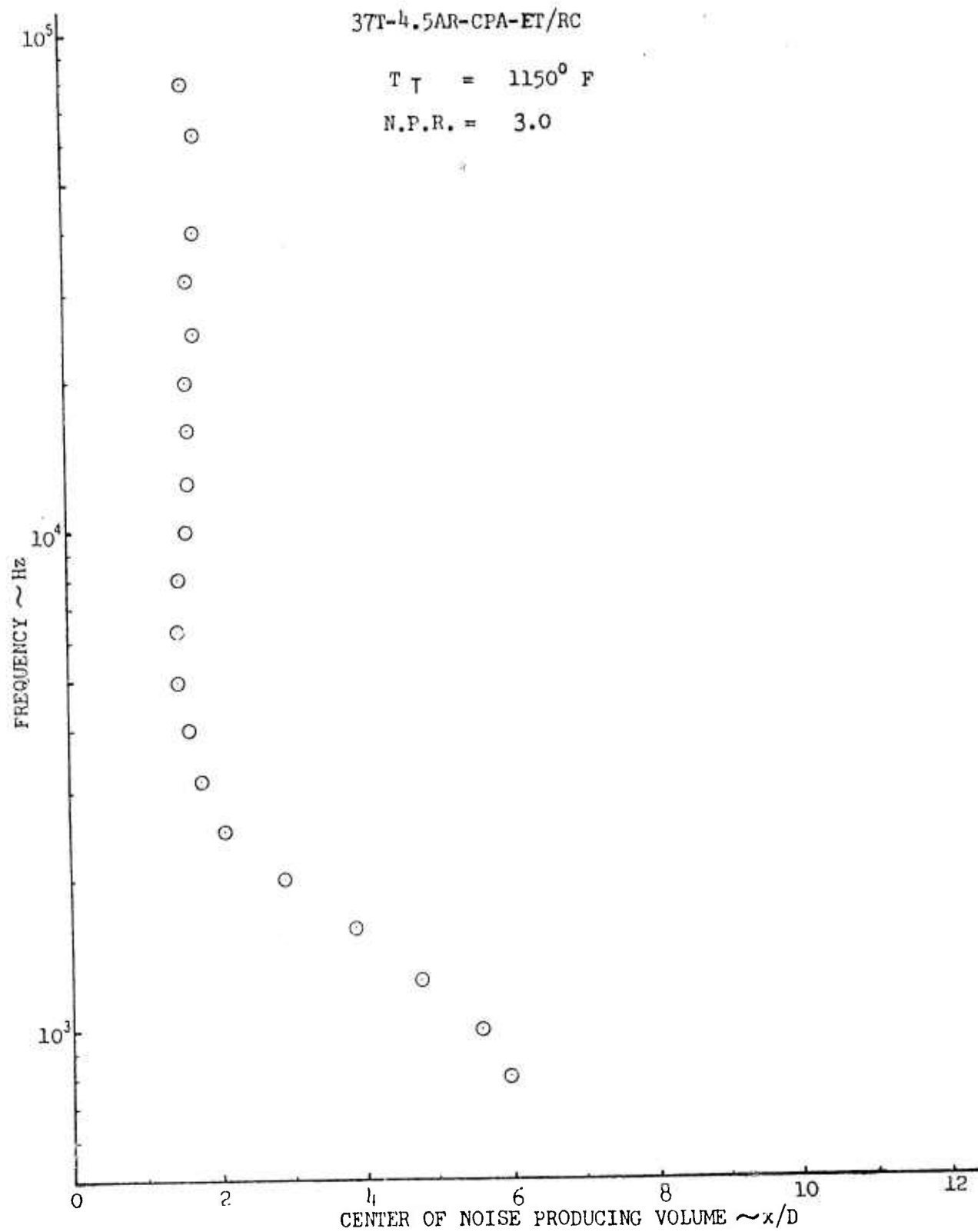


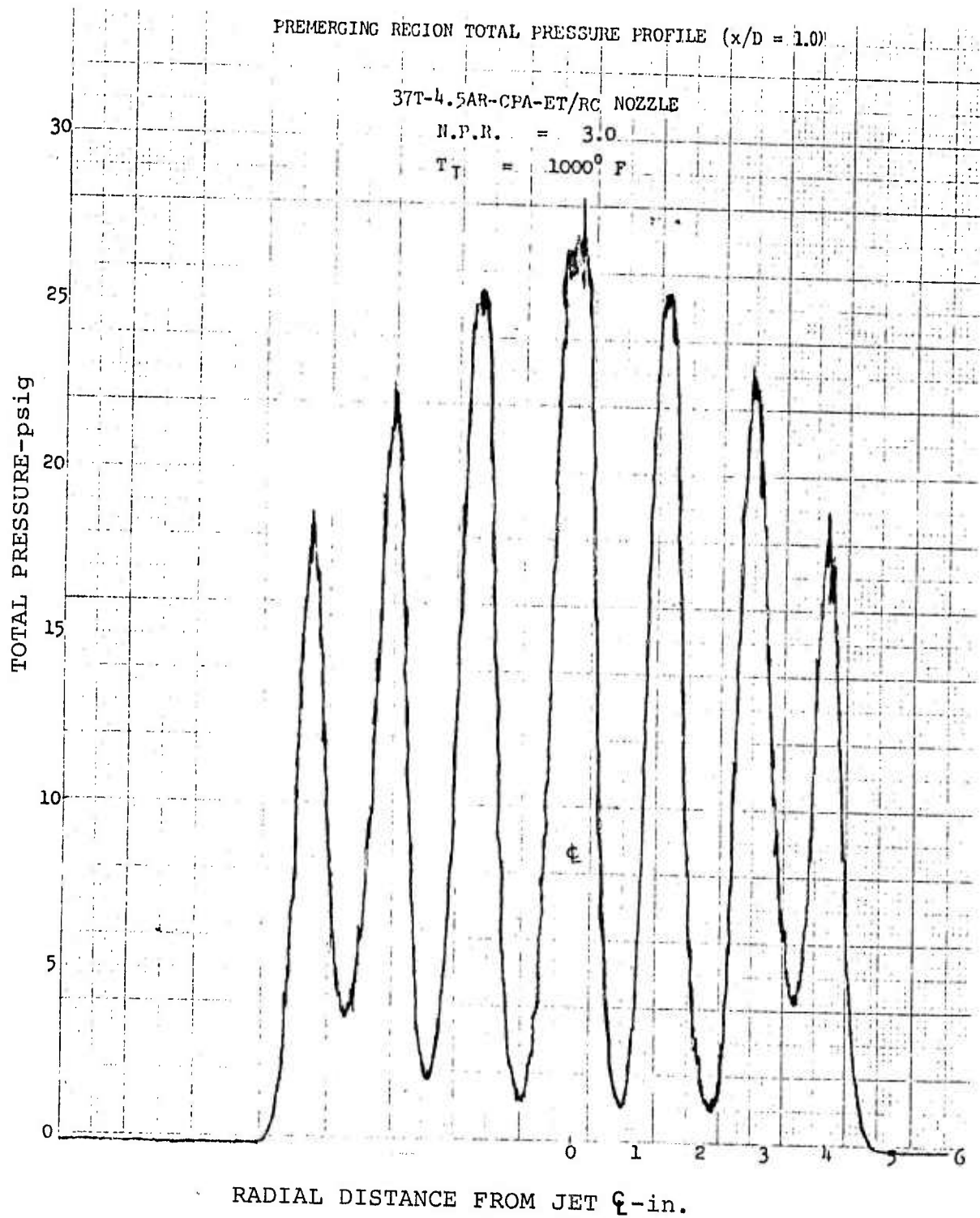
FREE FIELD VALUES

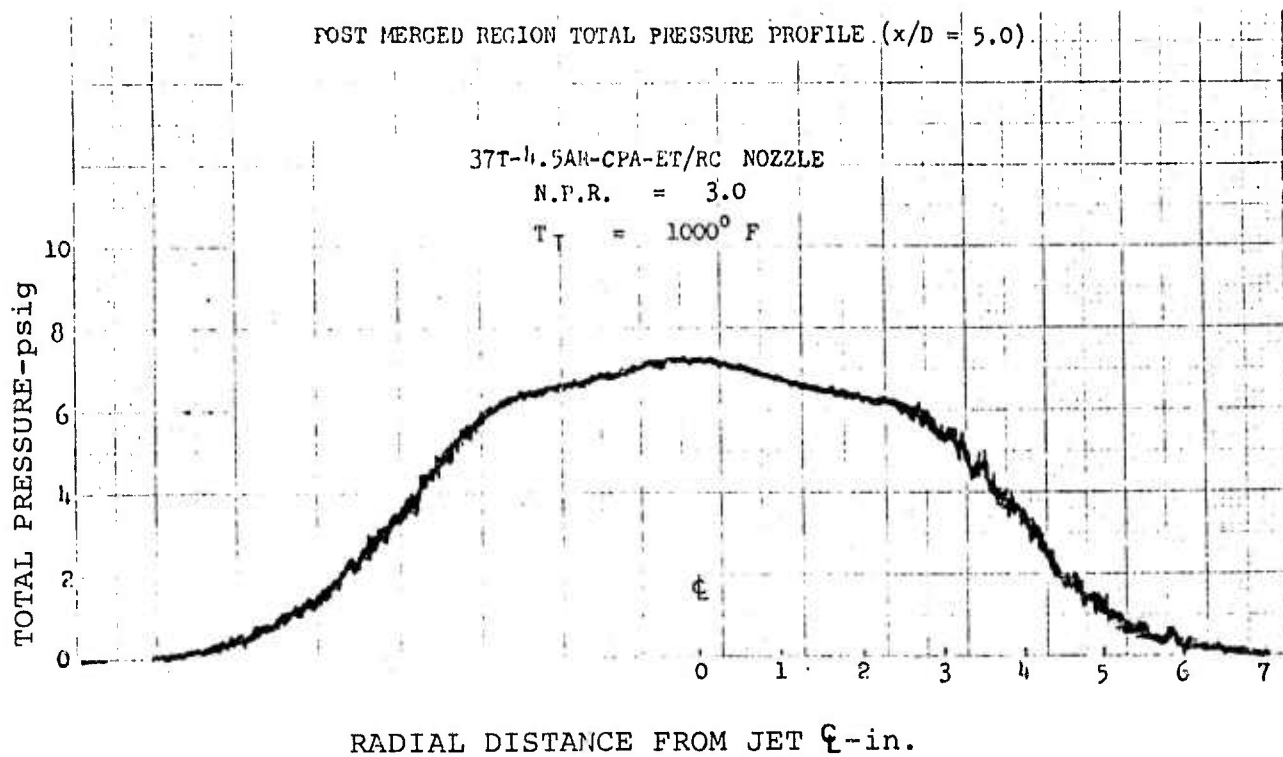


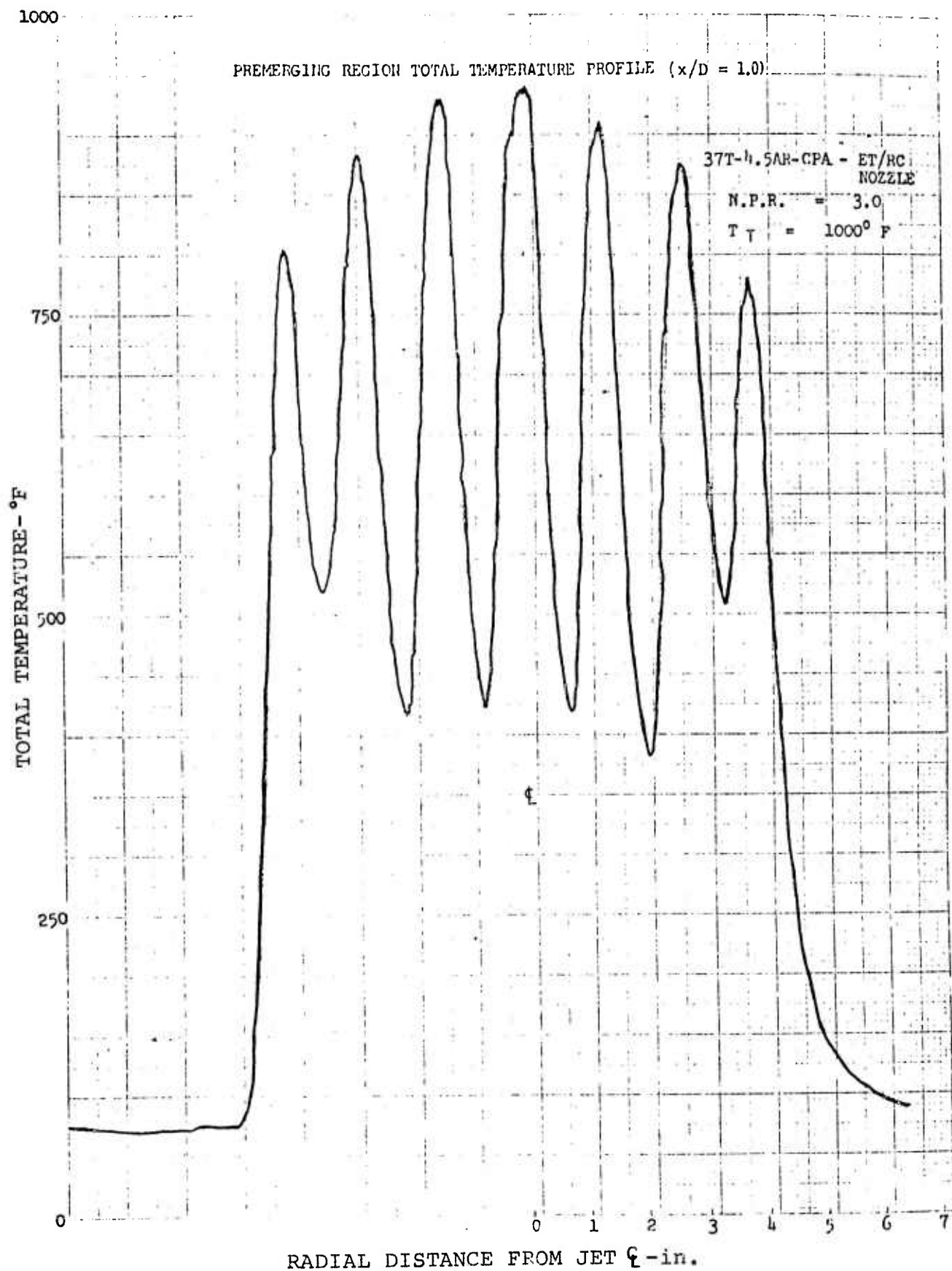
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	46	1150°F	3.0	14.00
◇	47	1150	3.0	16.00

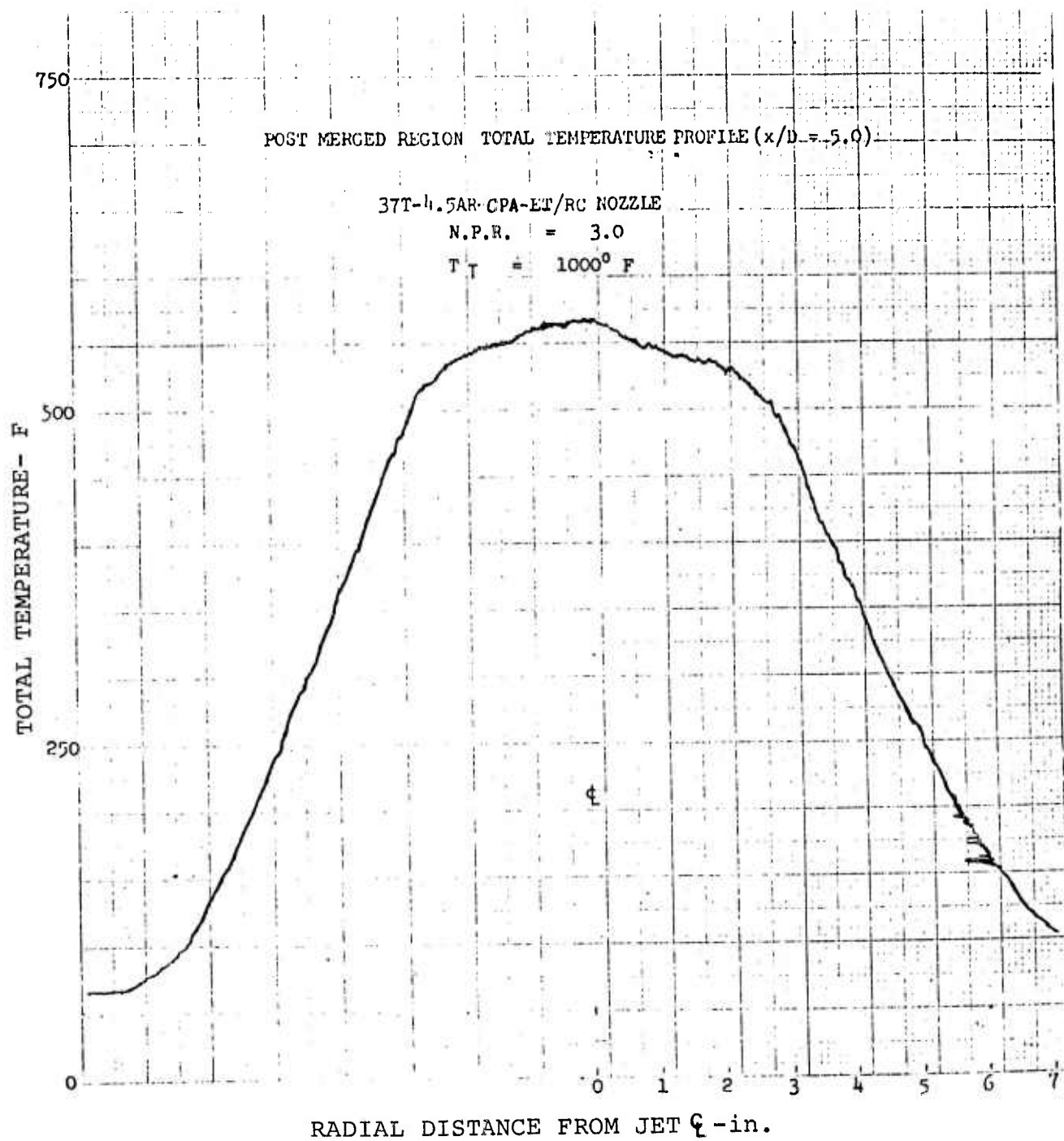




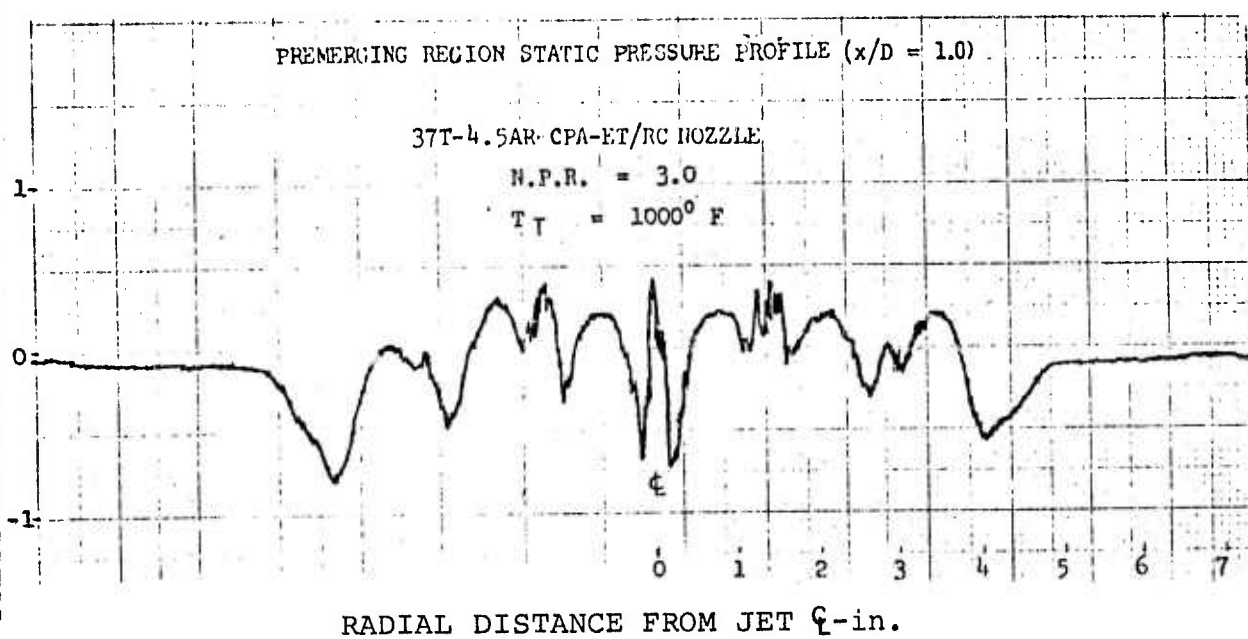




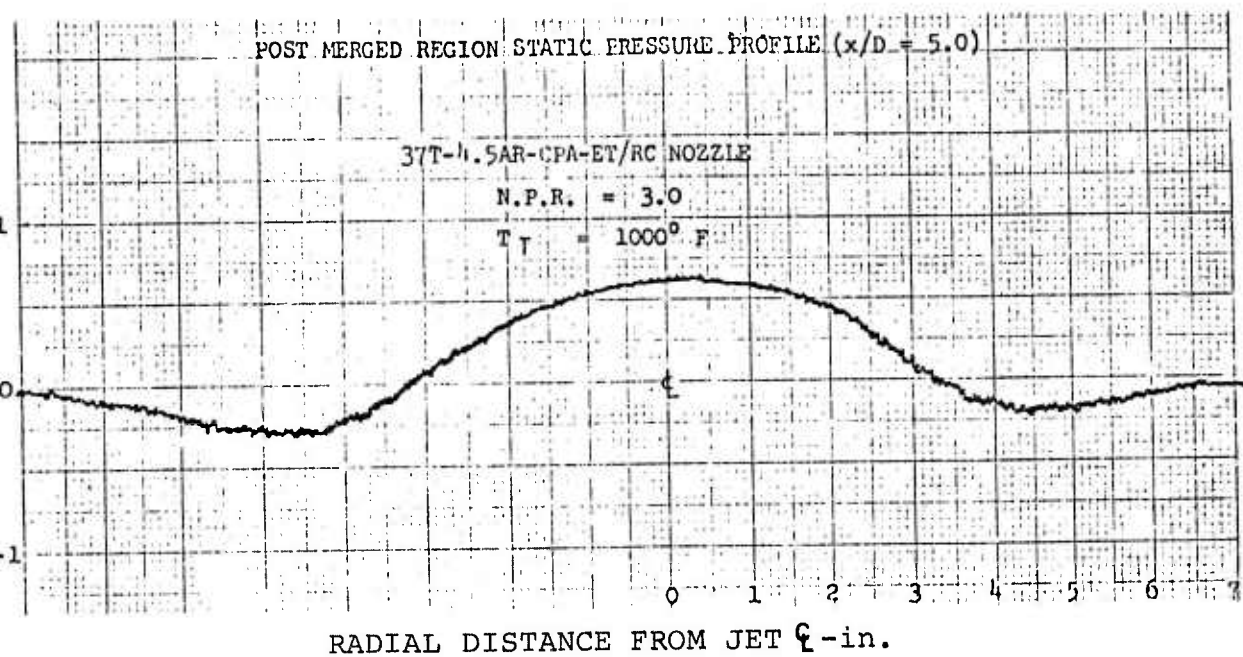




STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psi

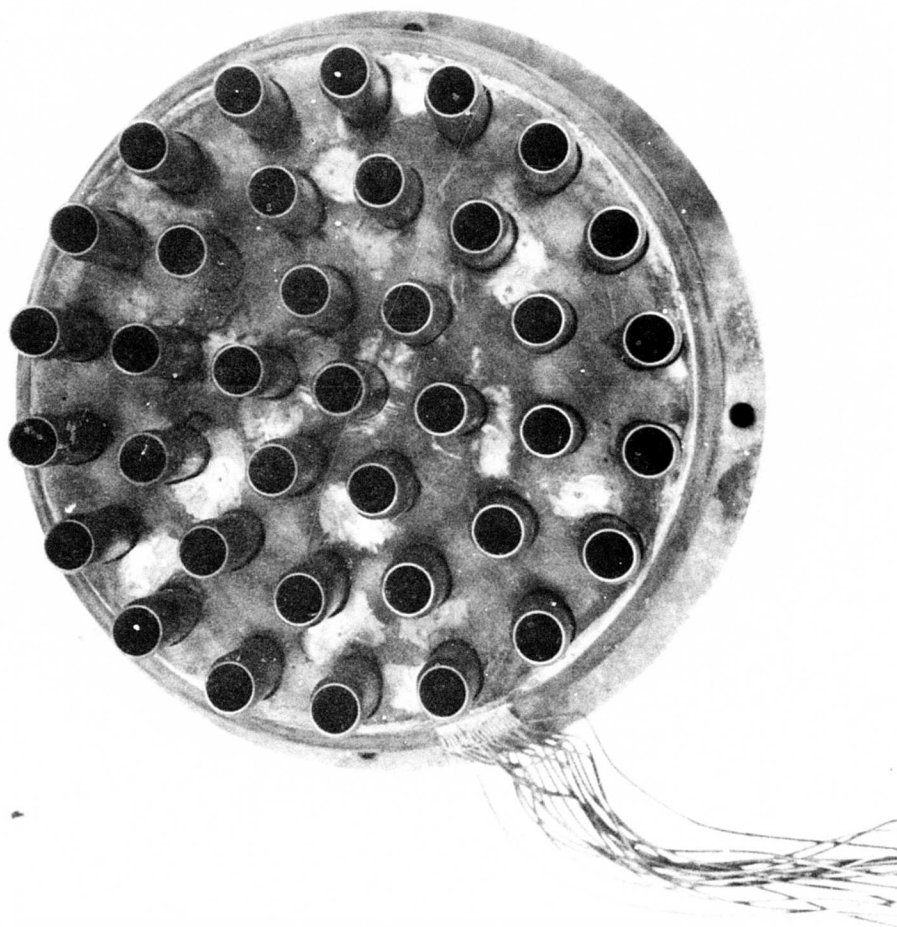


STATIC PRESSURE RELATIVE TO ATMOSPHERIC PRESSURE-psig





37T-6.0AR-CPA-ET/RC NOZZLE

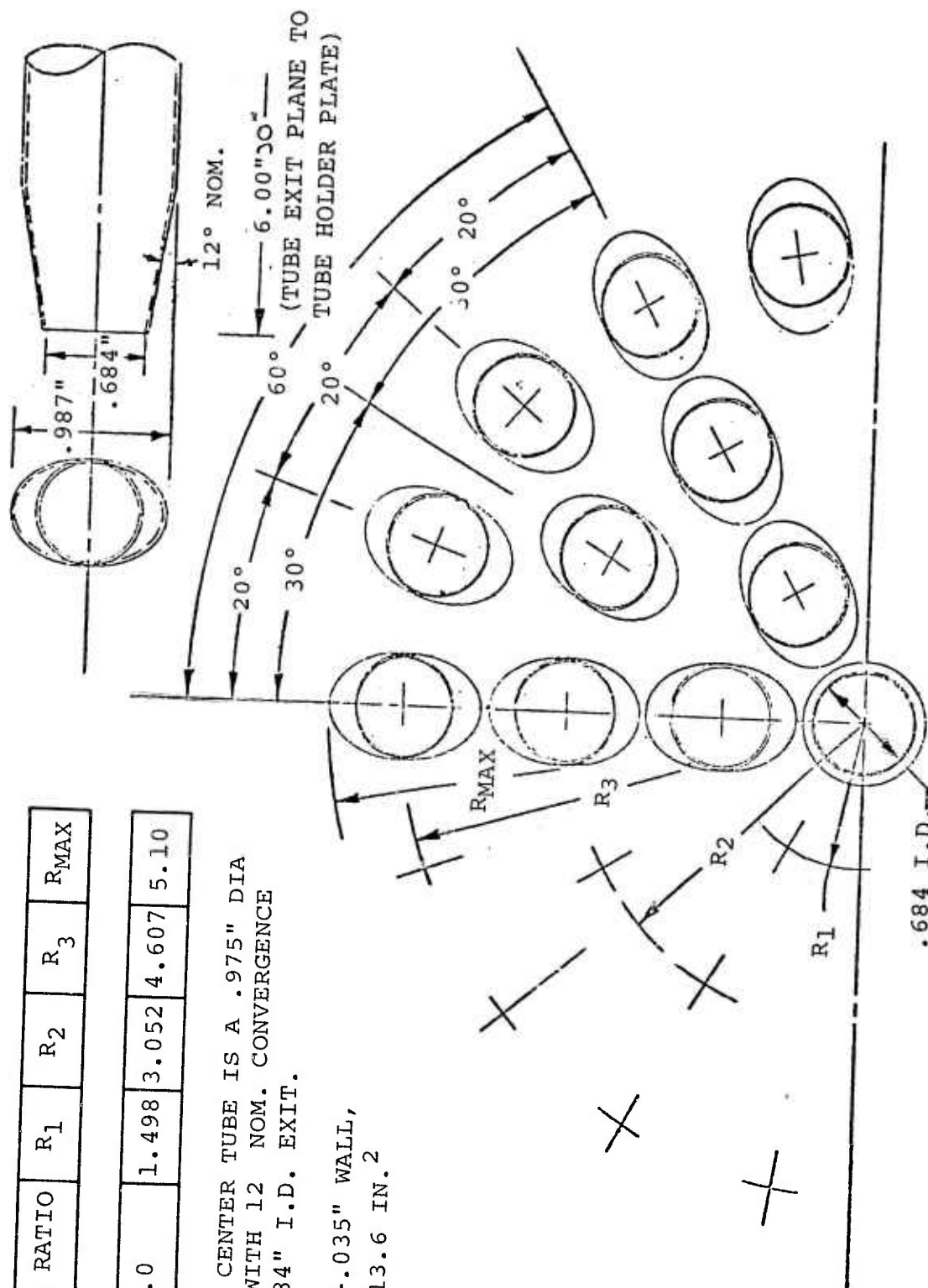


37T-6.0AR-CPA-ET/RC NOZZLE

AREA RATIO	R ₁	R ₂	R ₃	R _{MAX}
6.0	1.498	3.052	4.607	5.10

NOTE: CENTER TUBE IS A .975" DIA
TUBE WITH 12 NOM. CONVERGENCE
TO .684" I.D. EXIT.

MAT'L-.035" WALL,
A₈ = 13.6 IN.²



37 TUBE - AREA RATIO 6.0 ELLIPTICAL TUBES CLOSE ARRAY

TEST CONDITIONS

NOZZLE: 37T-6.0AR-CPA-ET/RC

FACILITY: HNTF

DATE: 10-22-73

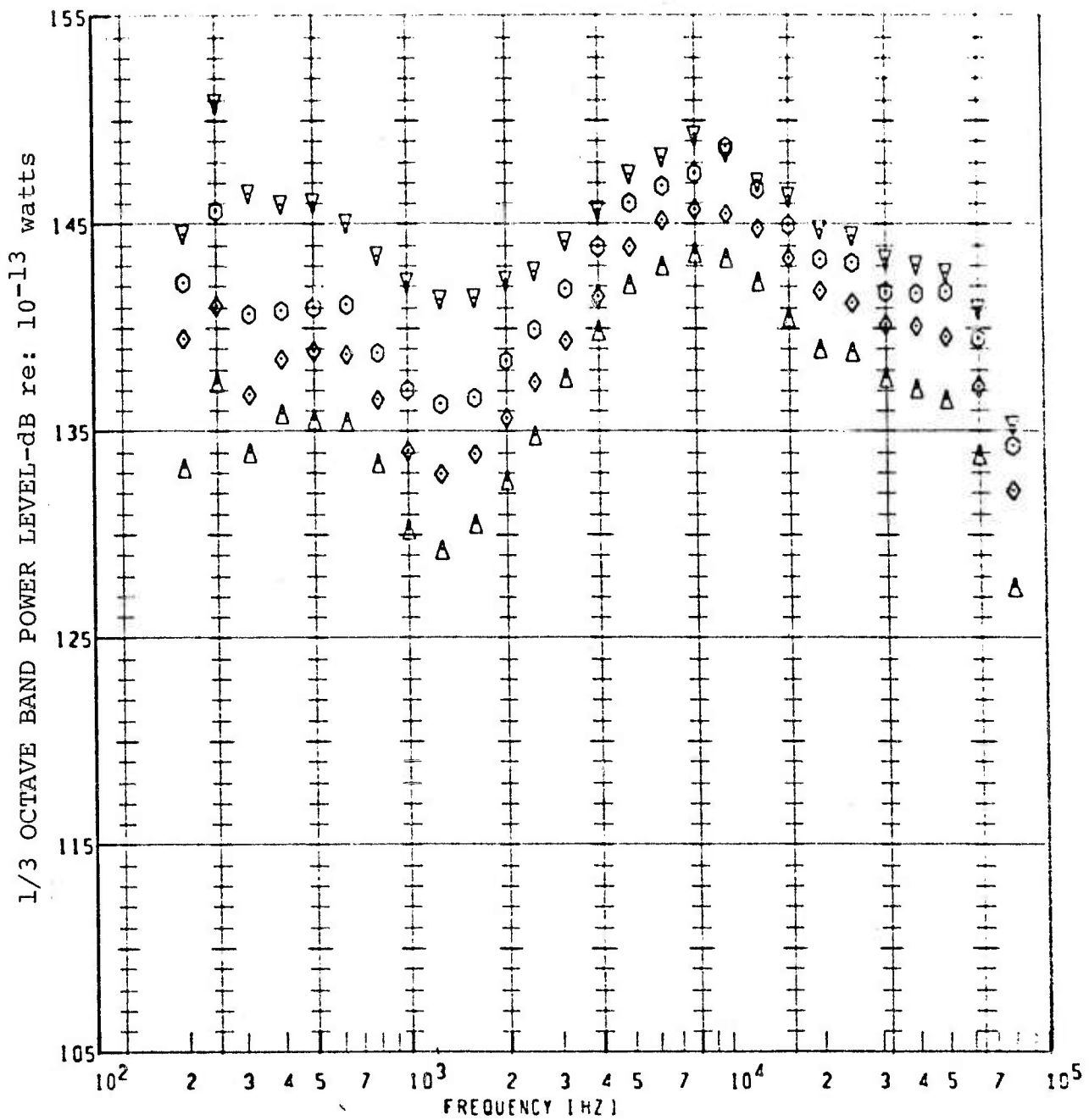
T_{AMB} = 51.5°F **R.H.** = 87%

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
193	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES

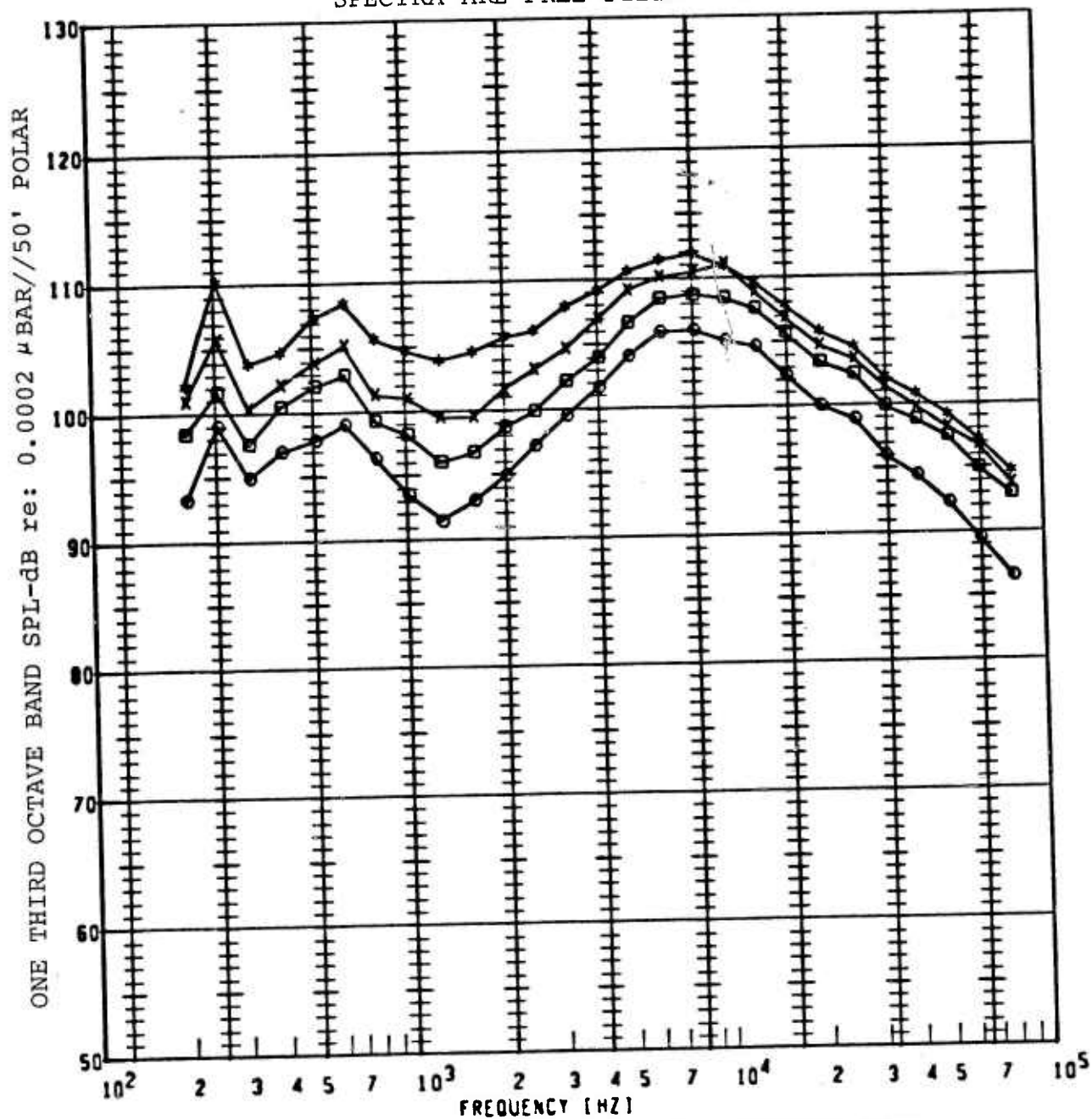


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	193	2.00	1150°F
◇	193	2.50	1150
○	193	3.00	1150
▽	193	4.00	1150

NOZZLE: 37T-6.0AR-CPA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

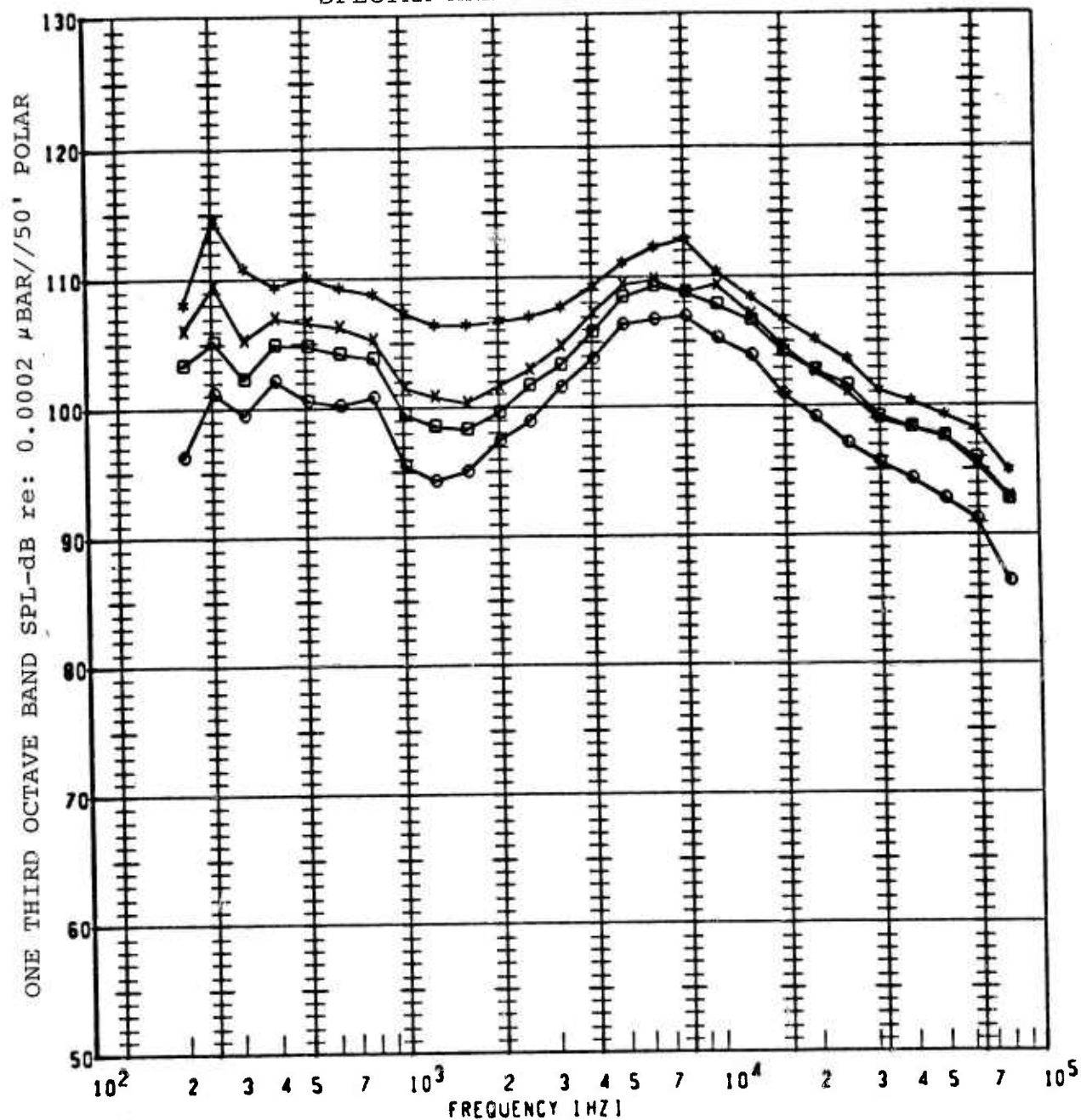


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
○	1936	1150°F	2.000	110°	50FP	114.6
□	1936	1150	2.500	↓	50FP	117.6
x	1936	1150	3.000	↓	50FP	119.7
*	1936	1150	4.000	↓	50FP	121.6

NOZZLE: 37T-6.0AR-CPA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

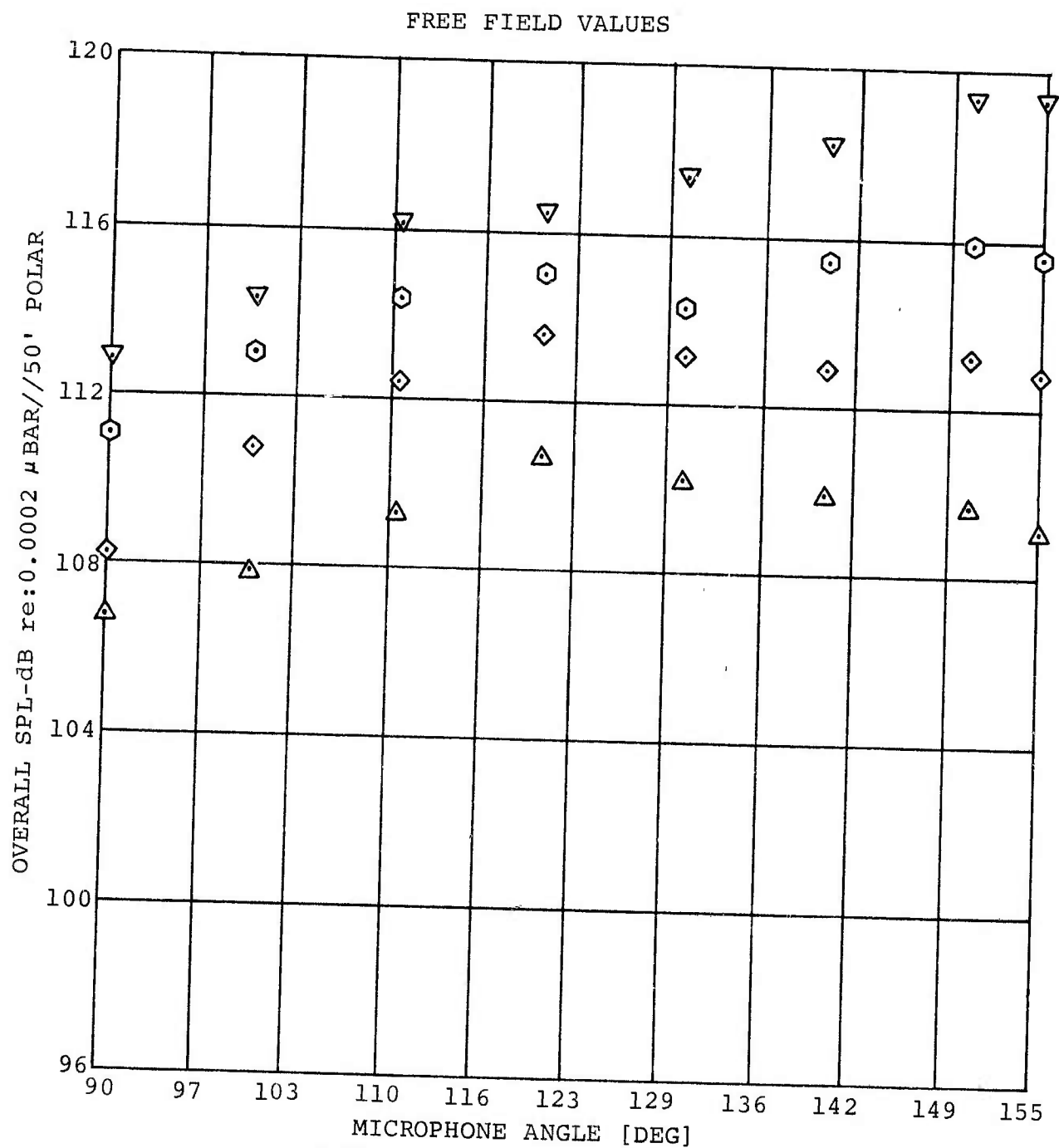
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
○	1936	1150°F	2.000	130°	50FP	115.7
◻	1936	1150	2.500	↓	50FP	118.5
x	1936	1150	3.000	↓	50FP	119.8
*	1936	1150	4.000	↓	50FP	123.0

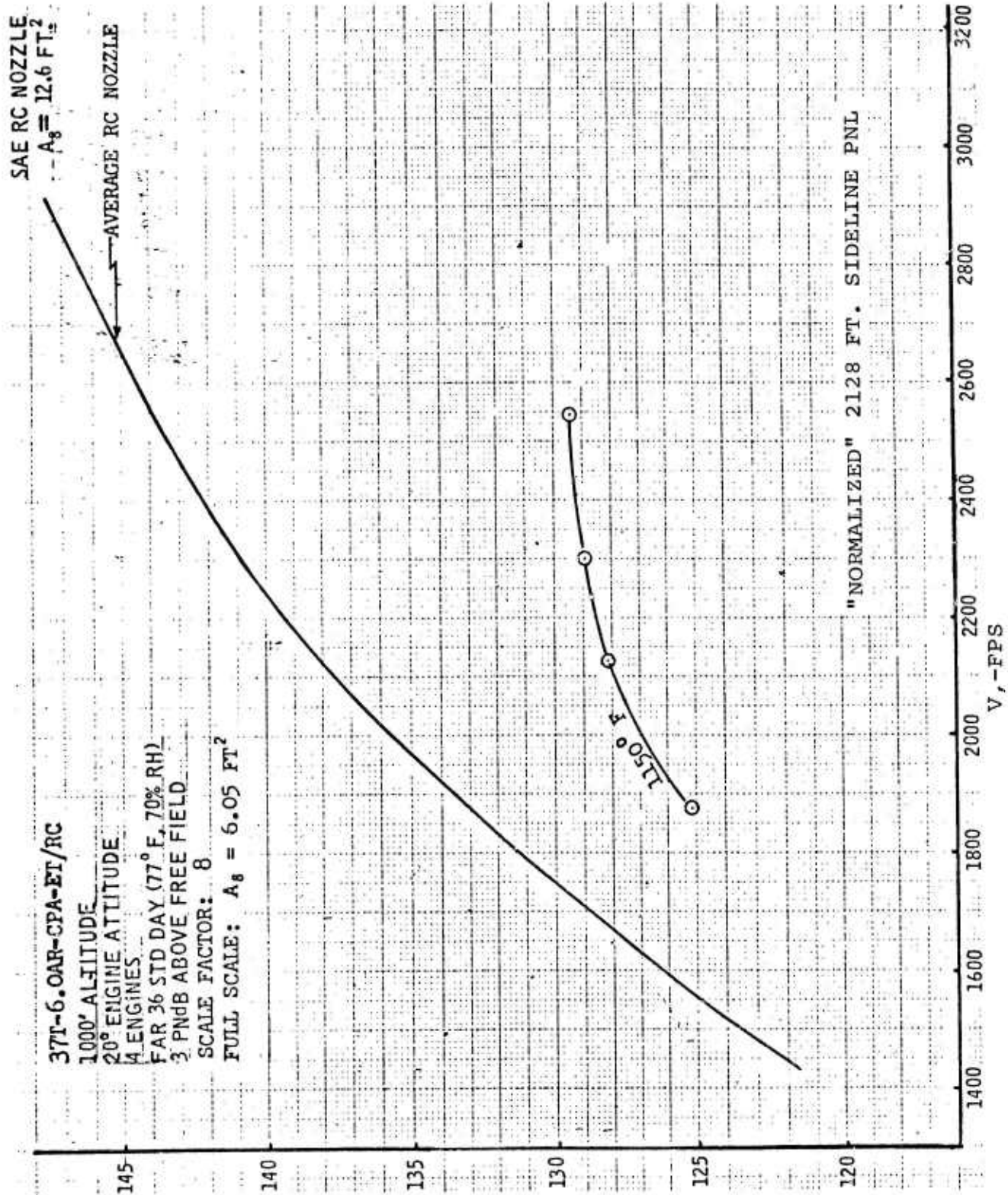
NOZZLE: 37T-6.0AR-CPA-ET/RC

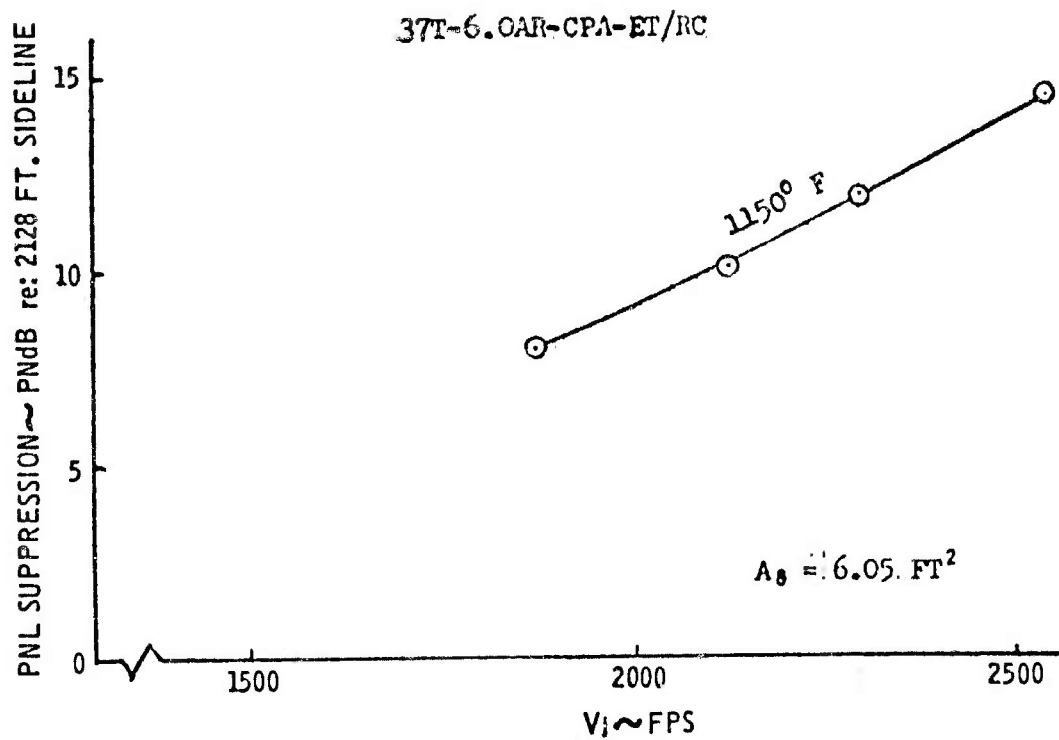
MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS



NOZZLE: 37T-6.0AR-CPA-ET/RC

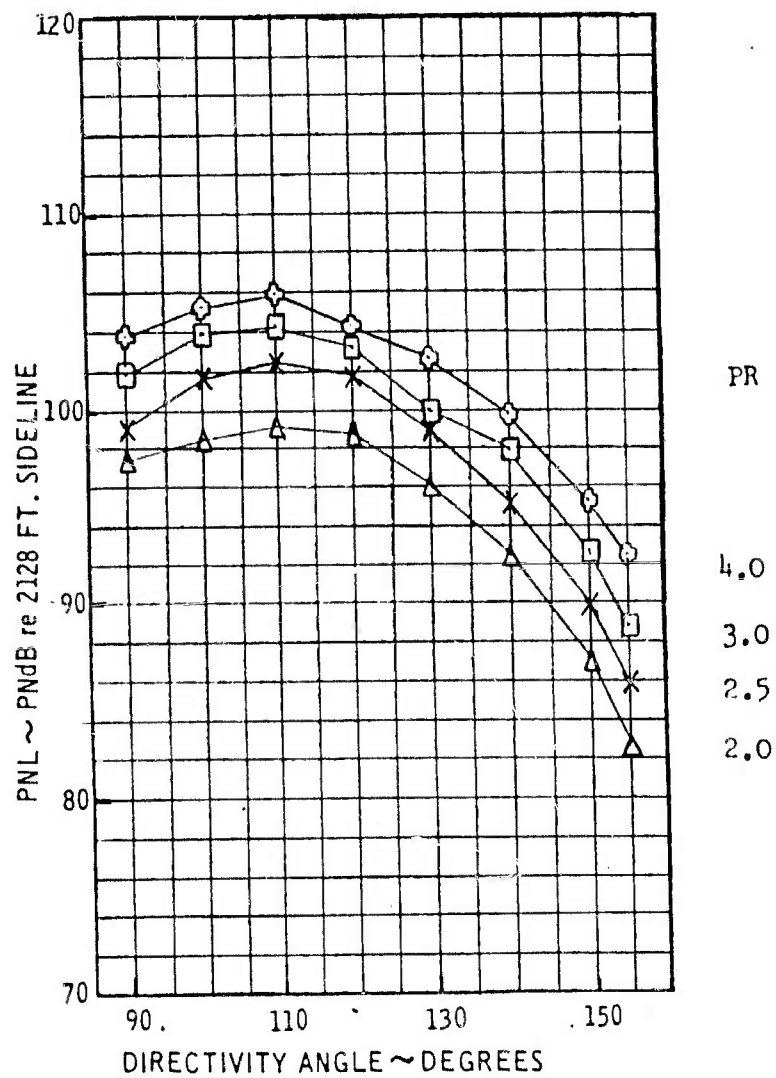
OASPL BEAM PATTERNS





PEAK PNL SUPPRESSION VALUES

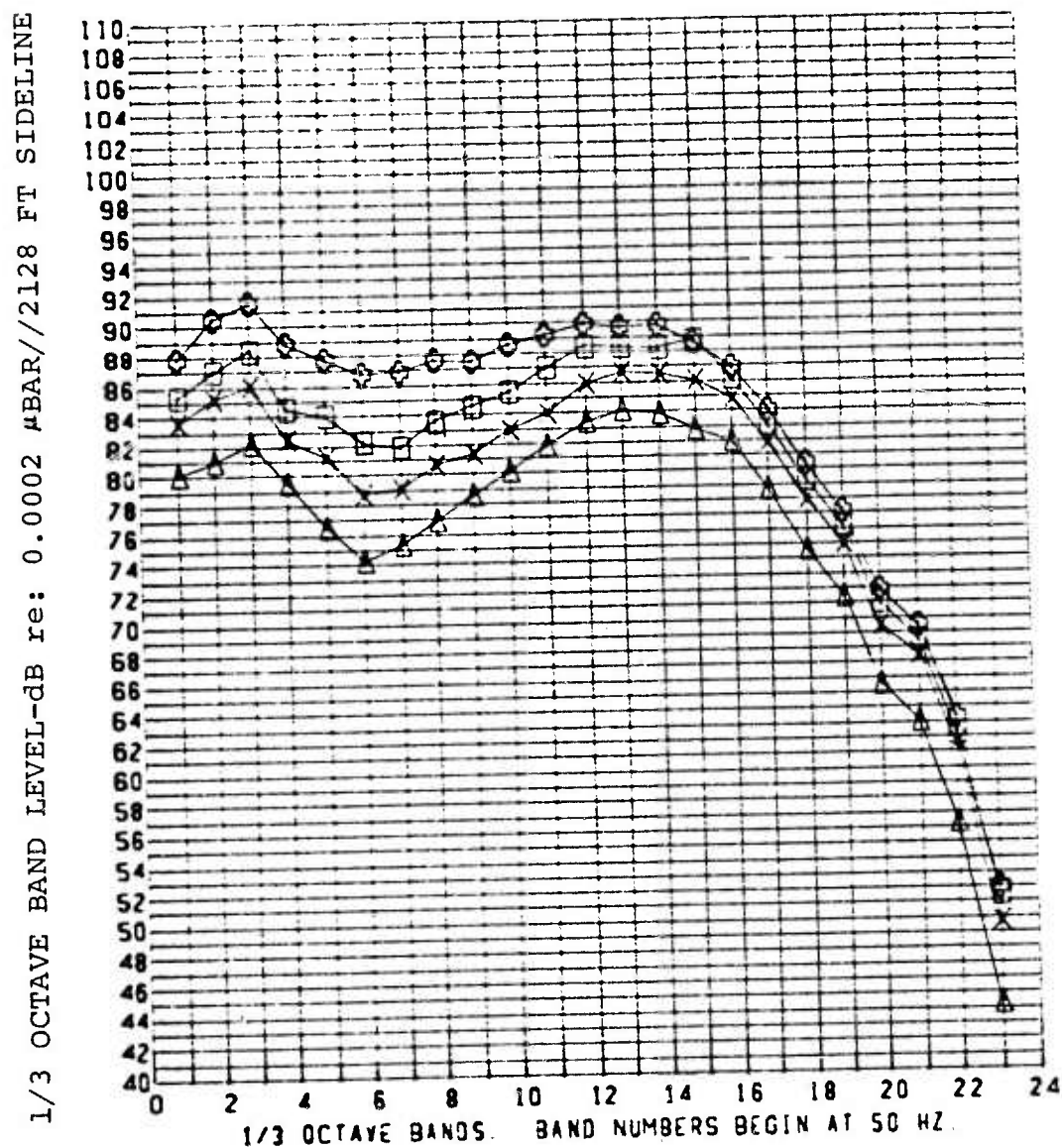
NOZZLE: 37T-6.0AR-CPA-BT/RC



RUN 193
 $T_T = 1150^{\circ} \text{ F}$ $A_8 = 6.05 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



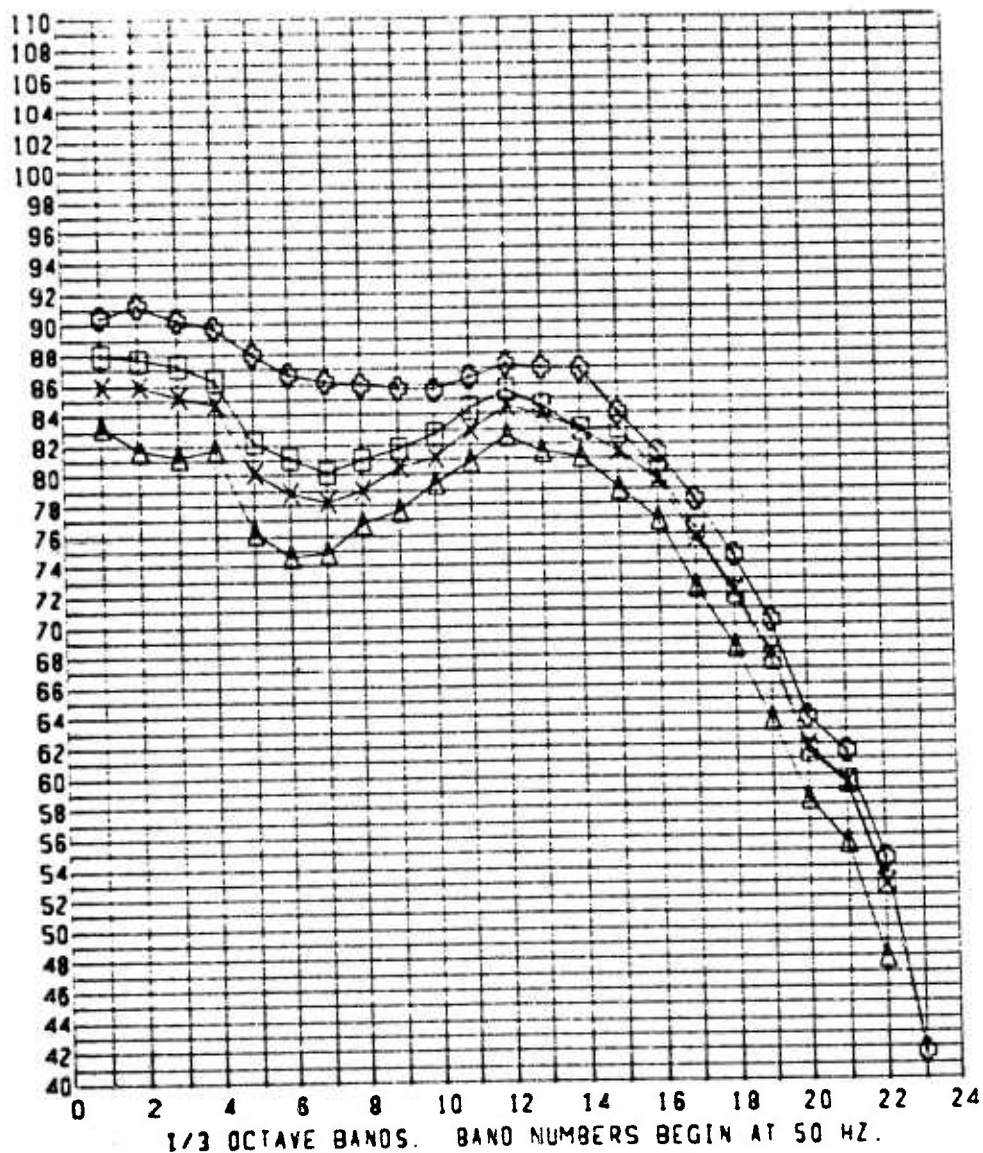
TT = 1150°F A8 = 6.05 FT² RUN: 193
 PR = Δ 2.0, X 2.5, \square 3.0, + 4.0

NOZZLE: 37T-6.0AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



TT = 1150°F A8 = 6.05 FT² RUN: 193
 PR = Δ 2.0, X 2.5, □ 3.0, + 3.4, ◇ 4.0

NOZZLE: 37T-6.0AR-CPA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
 re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-6.0AR-CPA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 15, 1973

P_{AMB} = 29.58 in Hg **T_{AMB}** = 46°F **R.H.** = 78%

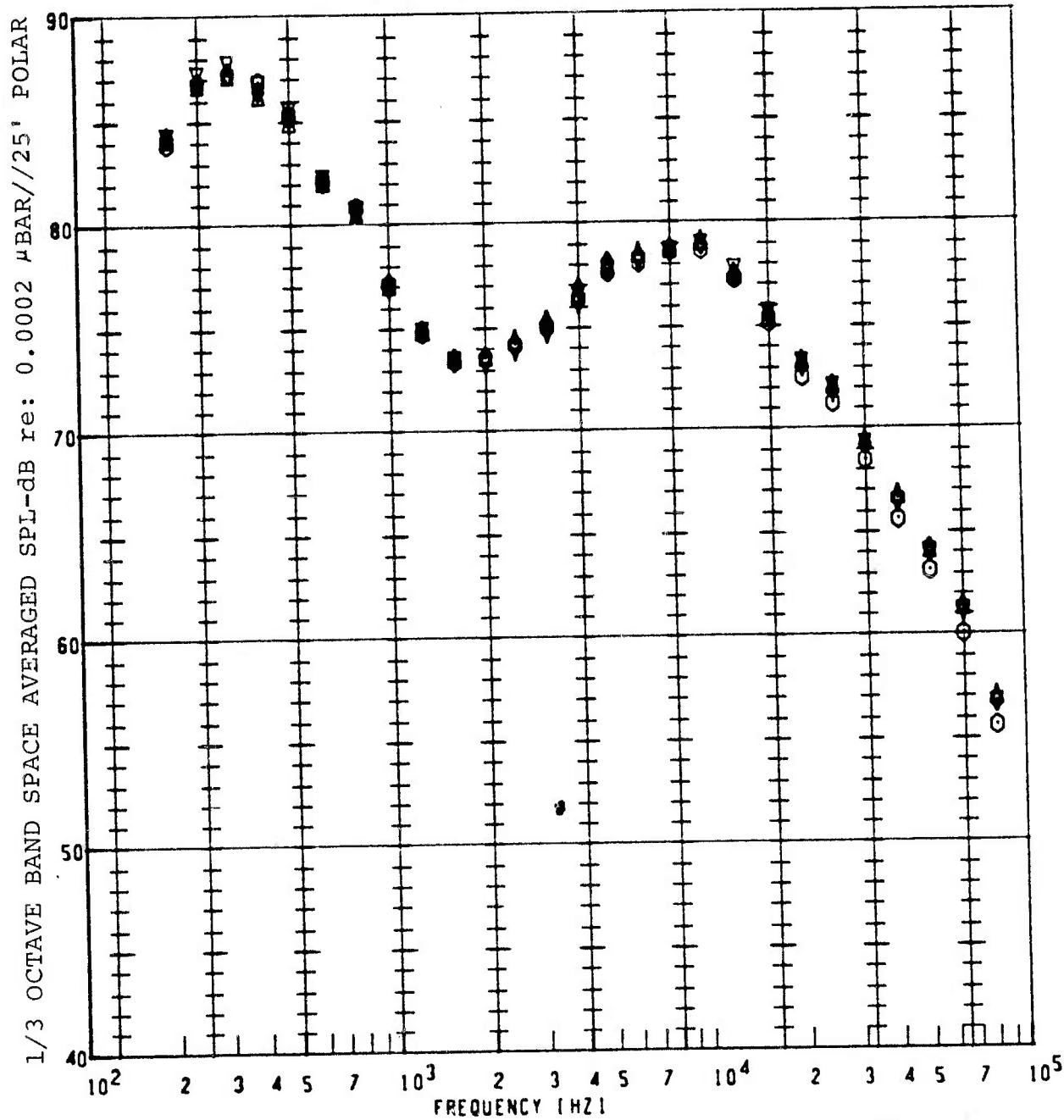
NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
2	0.0 x/D	12.5 in.		
3	.25	12.5		
4	.50	13.0		
5	.75	13.0		
6	1.00	13.5		
7	1.25	13.5		
8	1.50	14.0		
9	1.75	14.0		
10	2.00	14.5		
11	2.25	14.5		
12	2.50	15.0		
13	2.75	15.0		
14	3.0	15.5		
15	3.5	15.5		
16	4.0	16.0		
17	5.0	19.0		
18	6.0	20.0		
19	8.0	22.0		
20	10.0	24.0		
21	12.0	27.5		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES



PLOT
SYMBOL

RUN
NUMBER

JET
TEMP

PRESSURE AXIAL
RATIO LOCATION, x/D

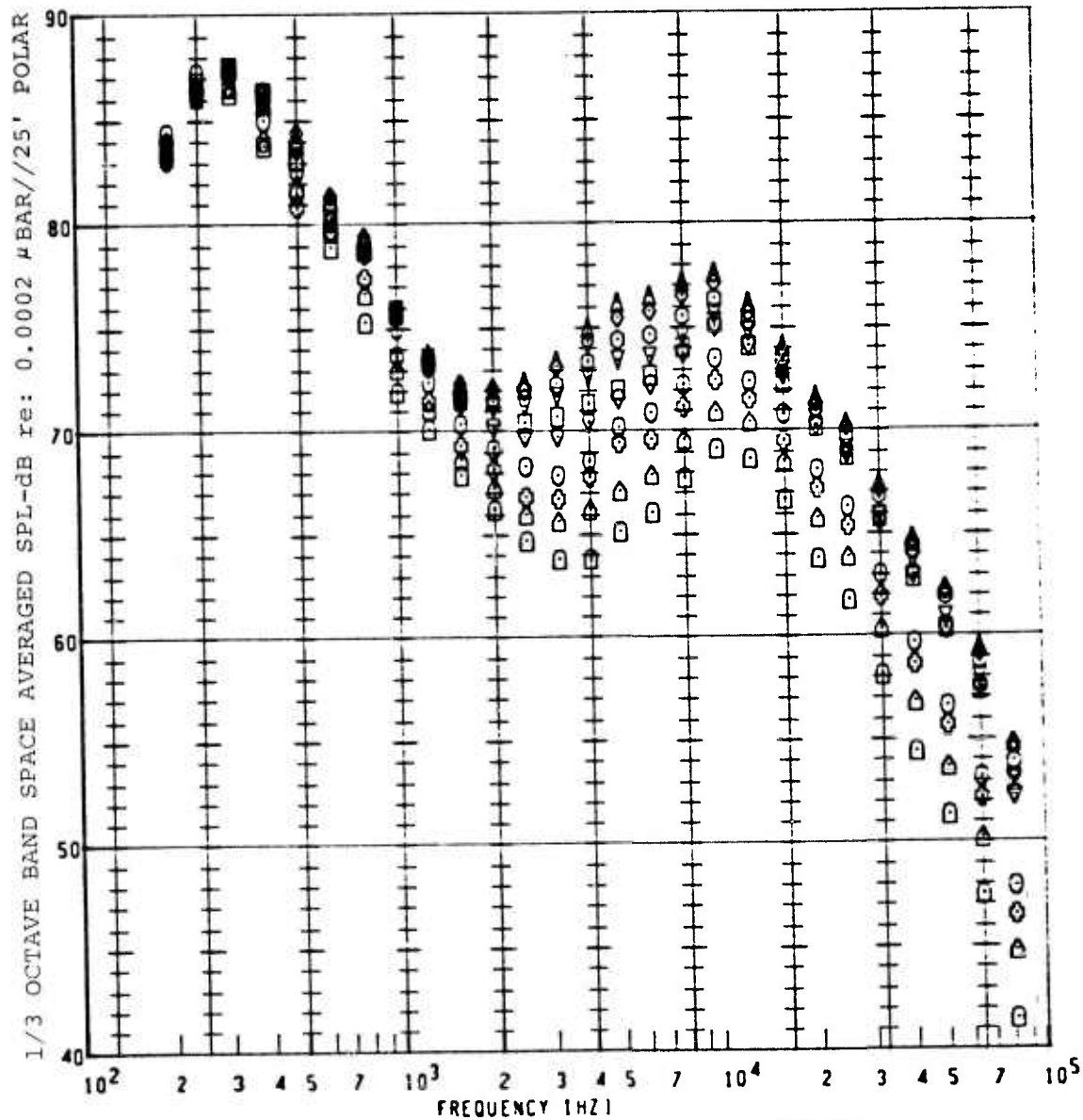
Δ
◇
○
▽

5
6
7
8

1150°F
1150
1150
1150

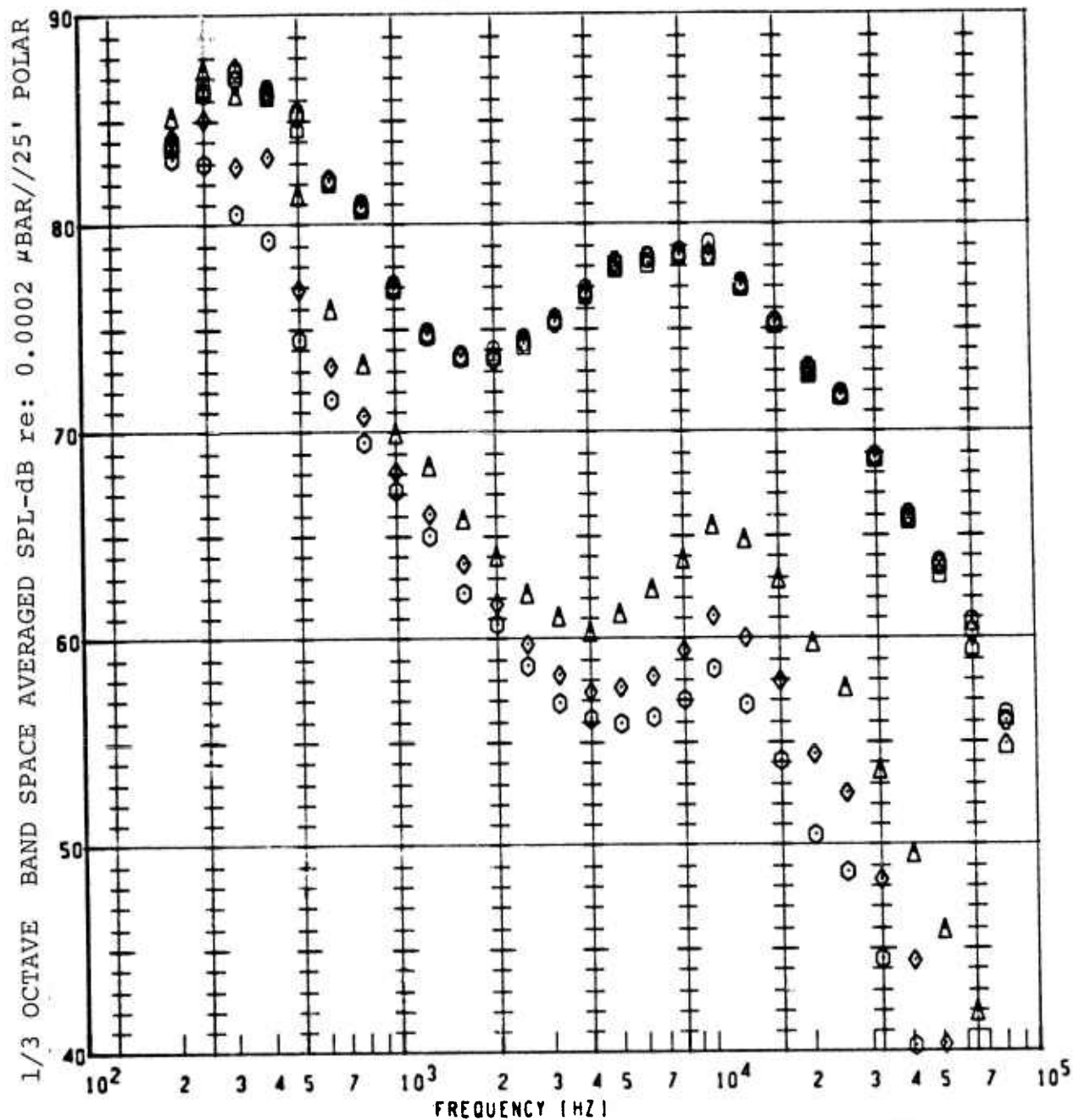
3.0 .75
3.0 1.0
3.0 1.25
3.0 1.5

FREE FIELD VALUES

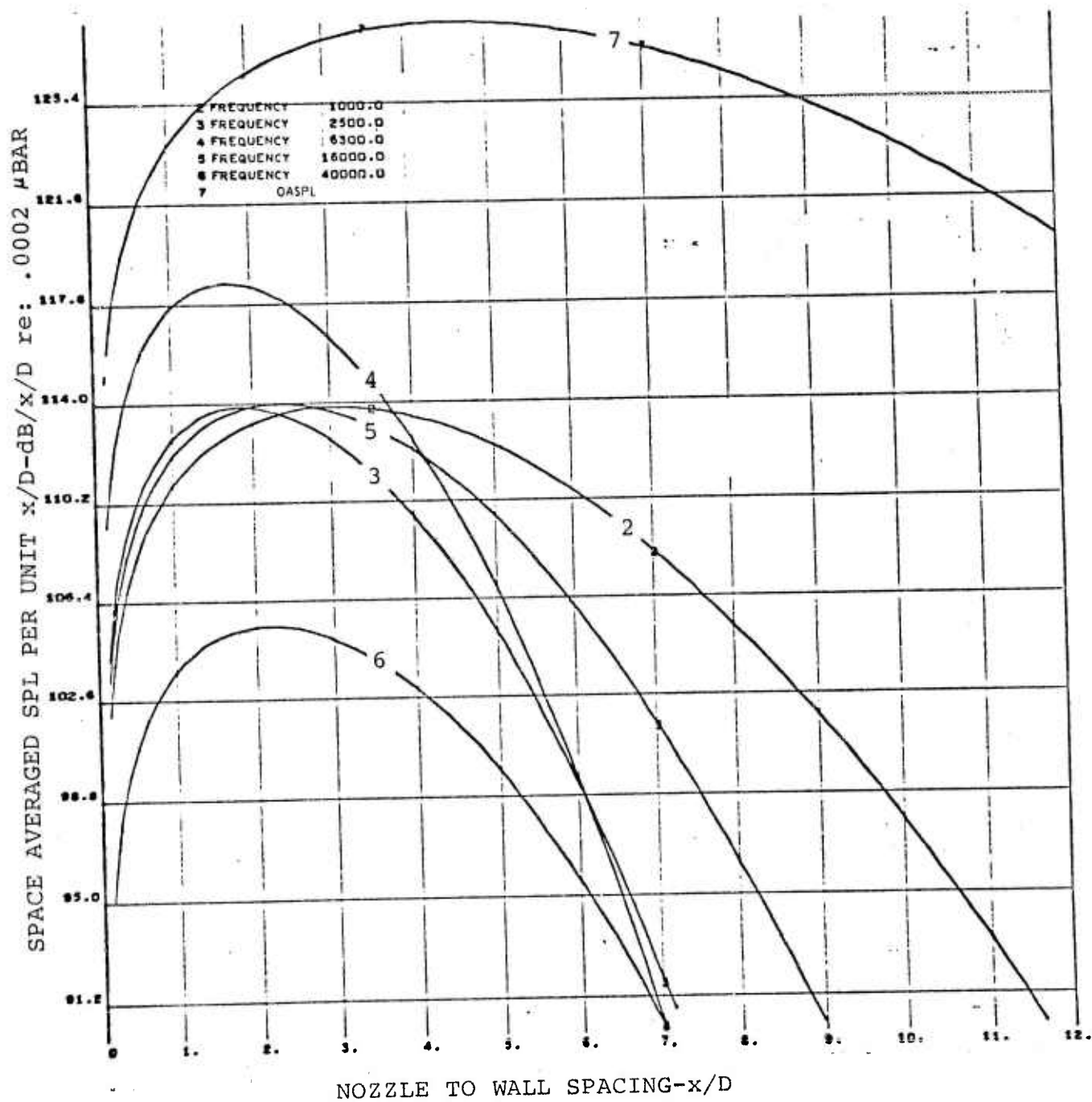


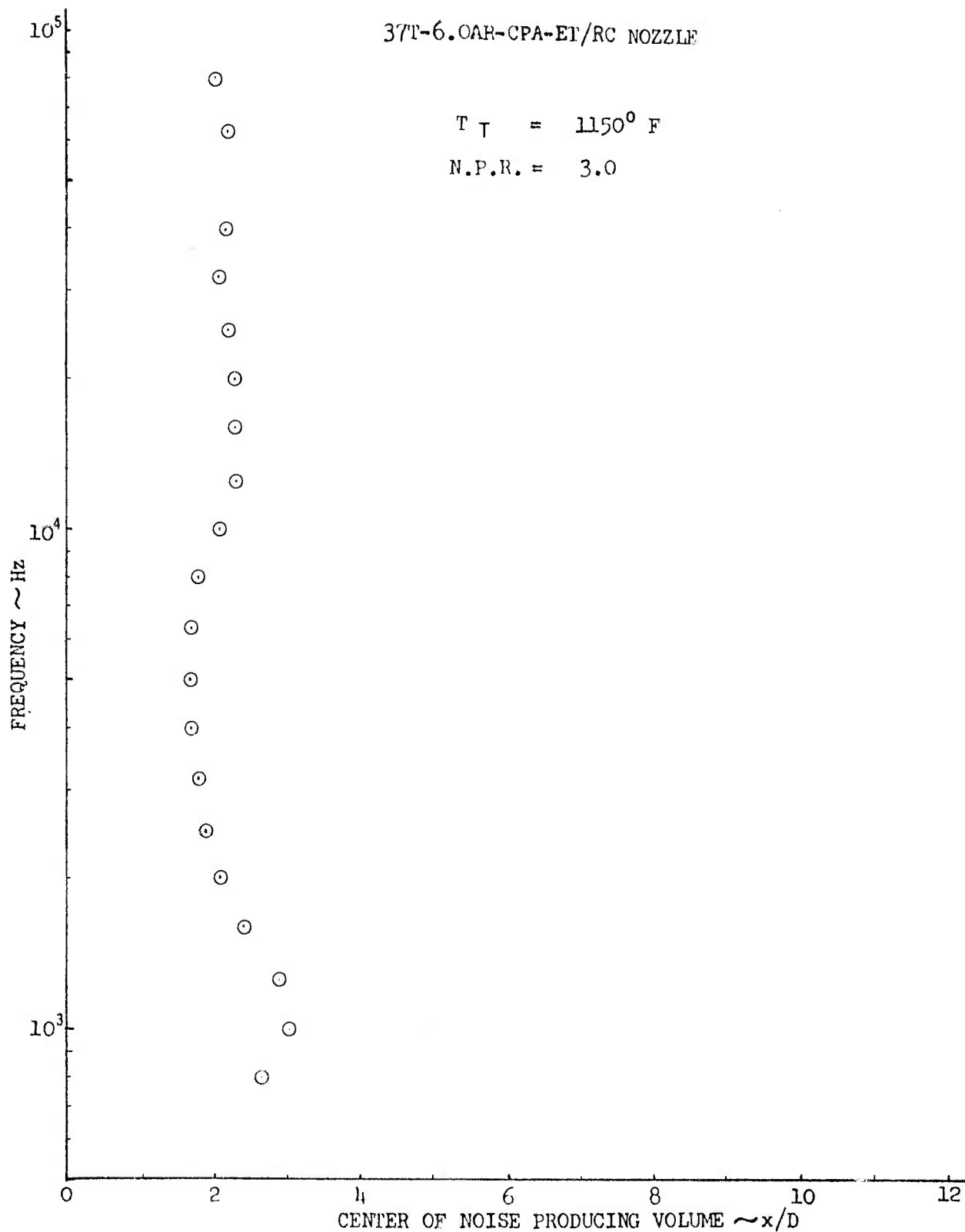
PLT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	9	1150°F	3.0	1.75
◇	10	1150	3.0	2.0
○	11	1150	3.0	2.25
▽	12	1150	3.0	2.50
□	13	1150	3.0	2.75
◊	14	1150	3.0	3.0
○	15	1150	3.0	3.50
◇	16	1150	3.0	4.0
△	17	1150	3.0	5.0
◻	18	1150	3.0	6.0

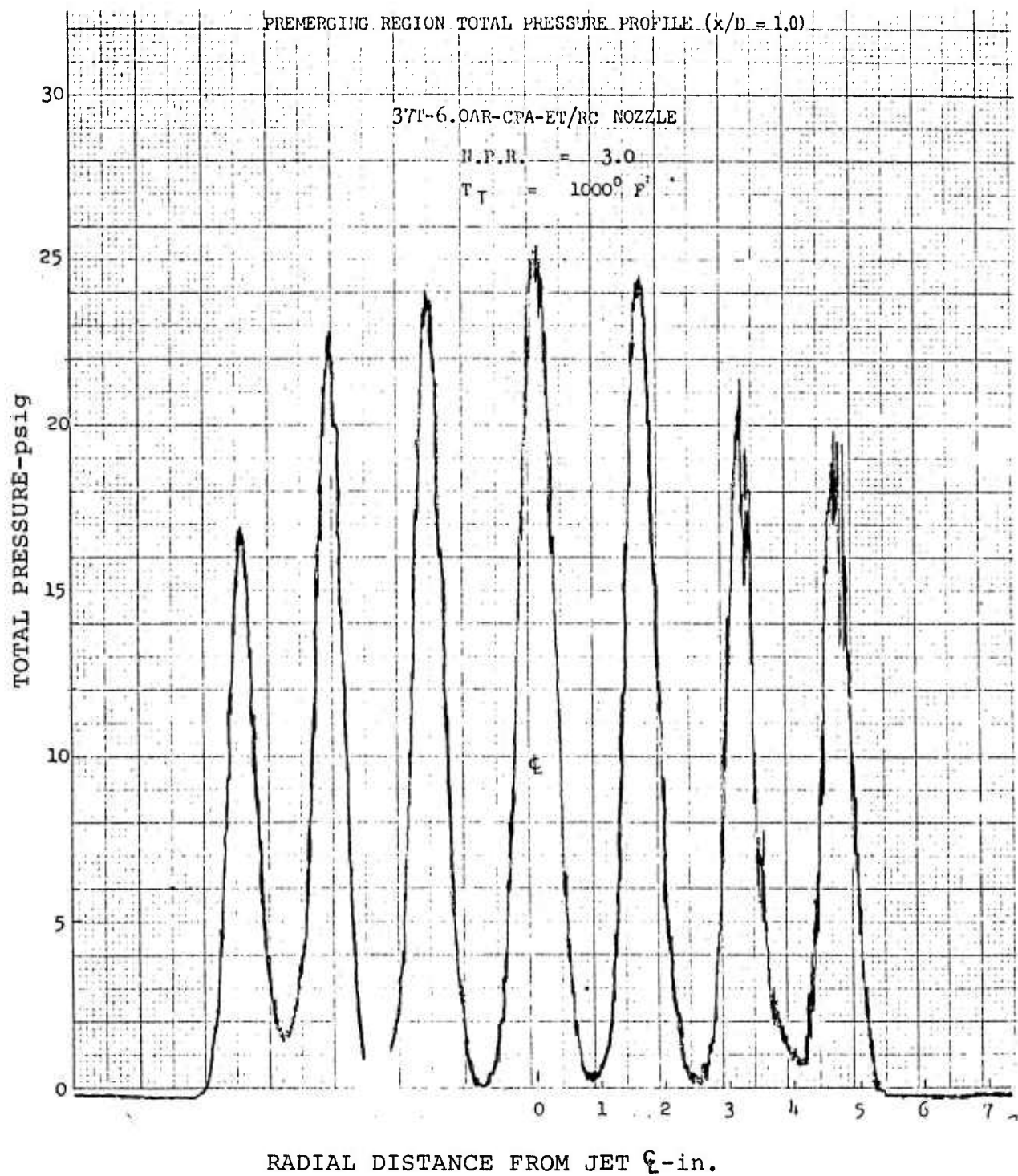
FREE FIELD VALUES

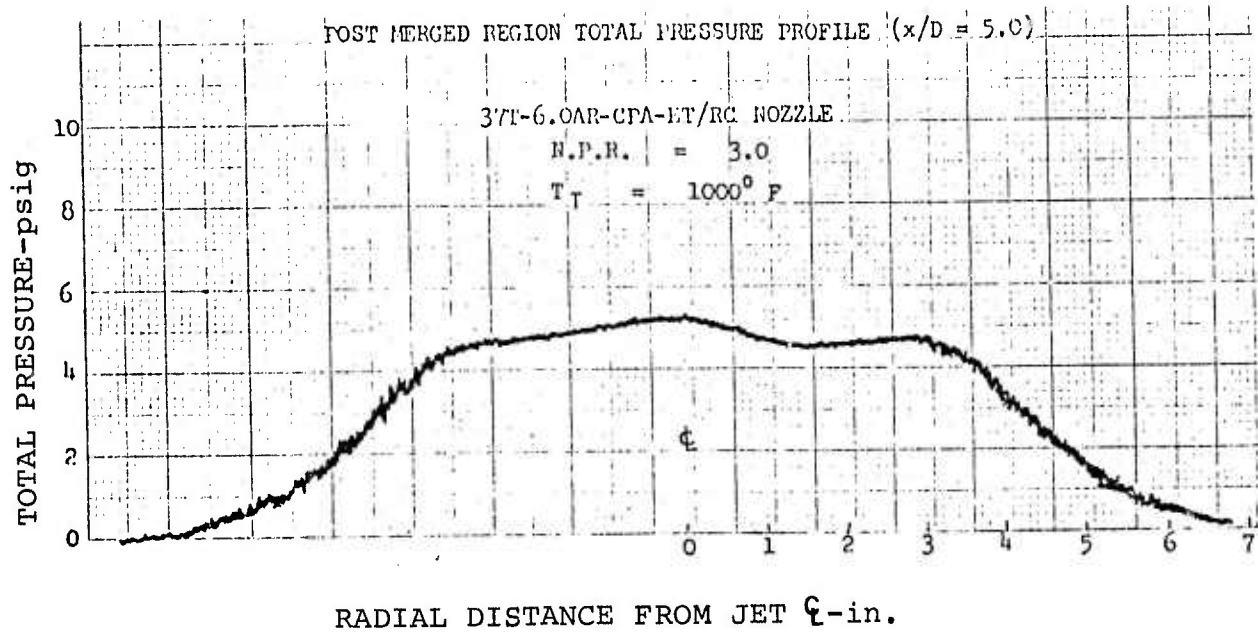


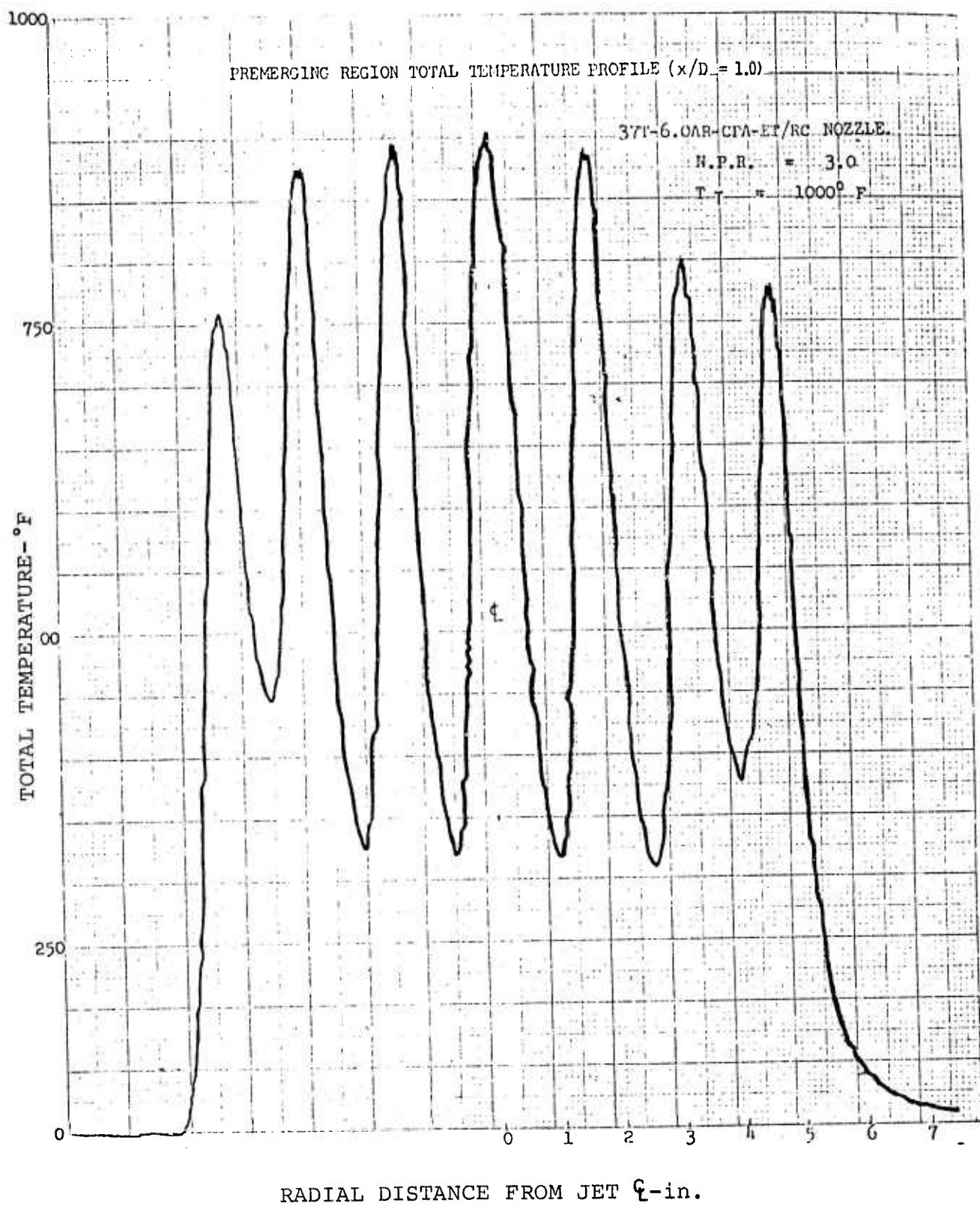
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	19	1150°F	3.0	8.0
\diamond	20	1150	3.0	0.0
\circ	21	1150	3.0	2.0
\odot	2	1150	3.0	0
\triangle	3	1150	3.0	.25
\square	4	1150	3.0	.5

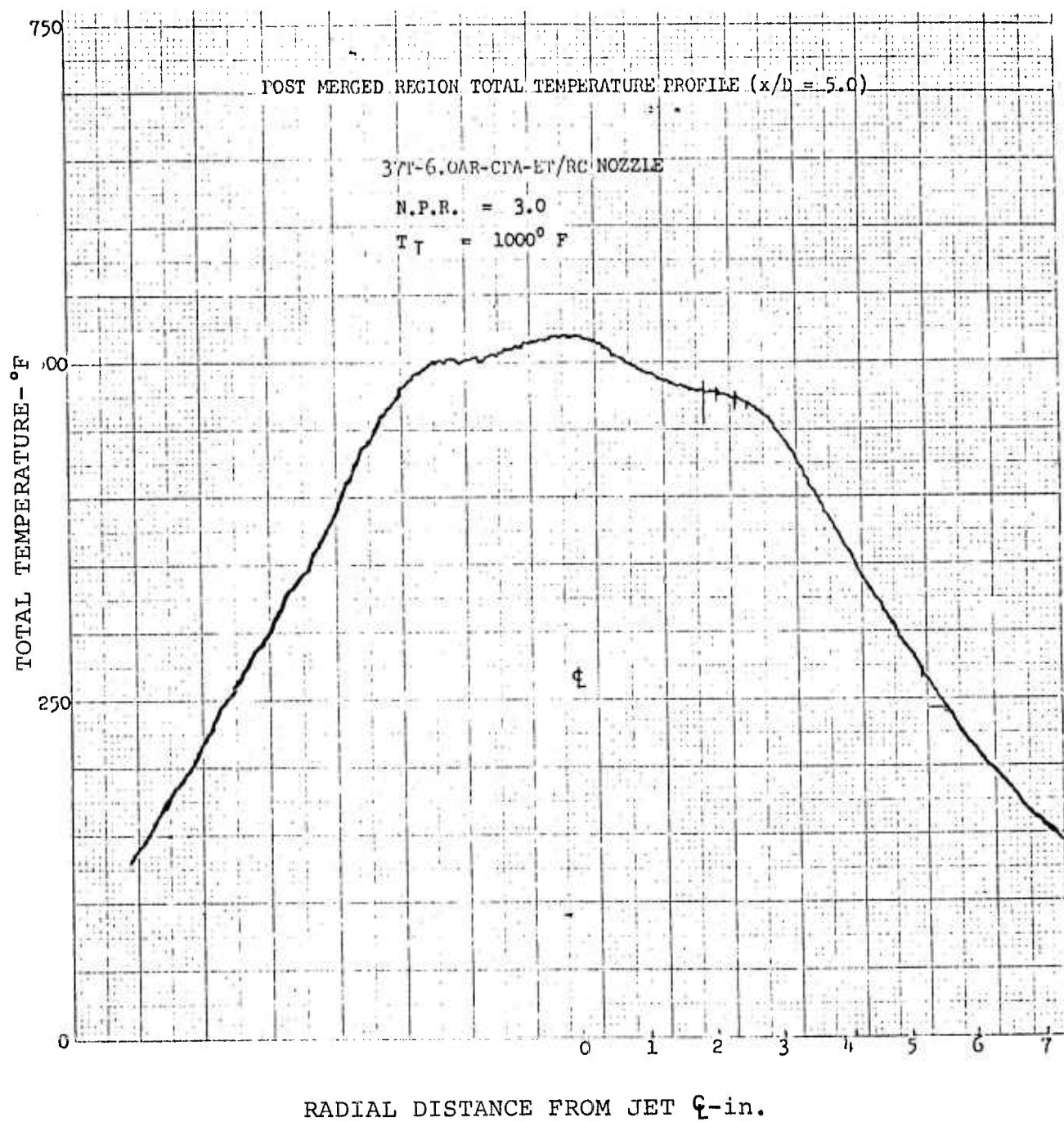


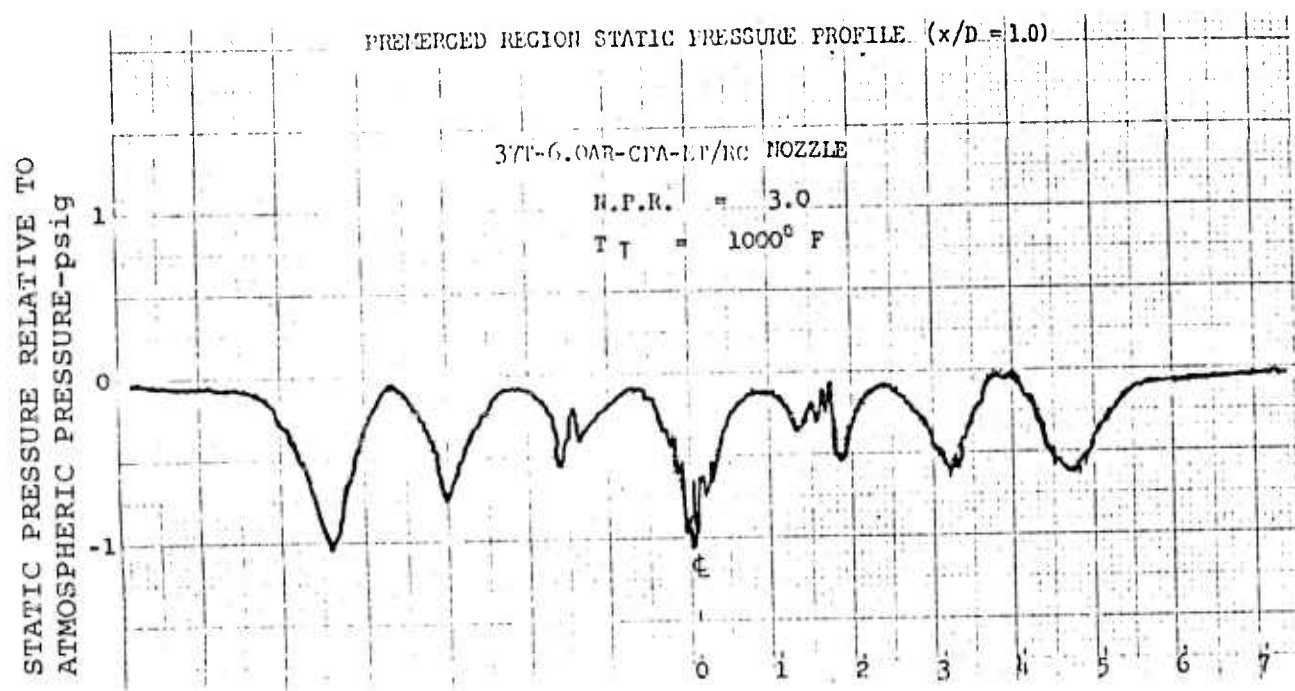




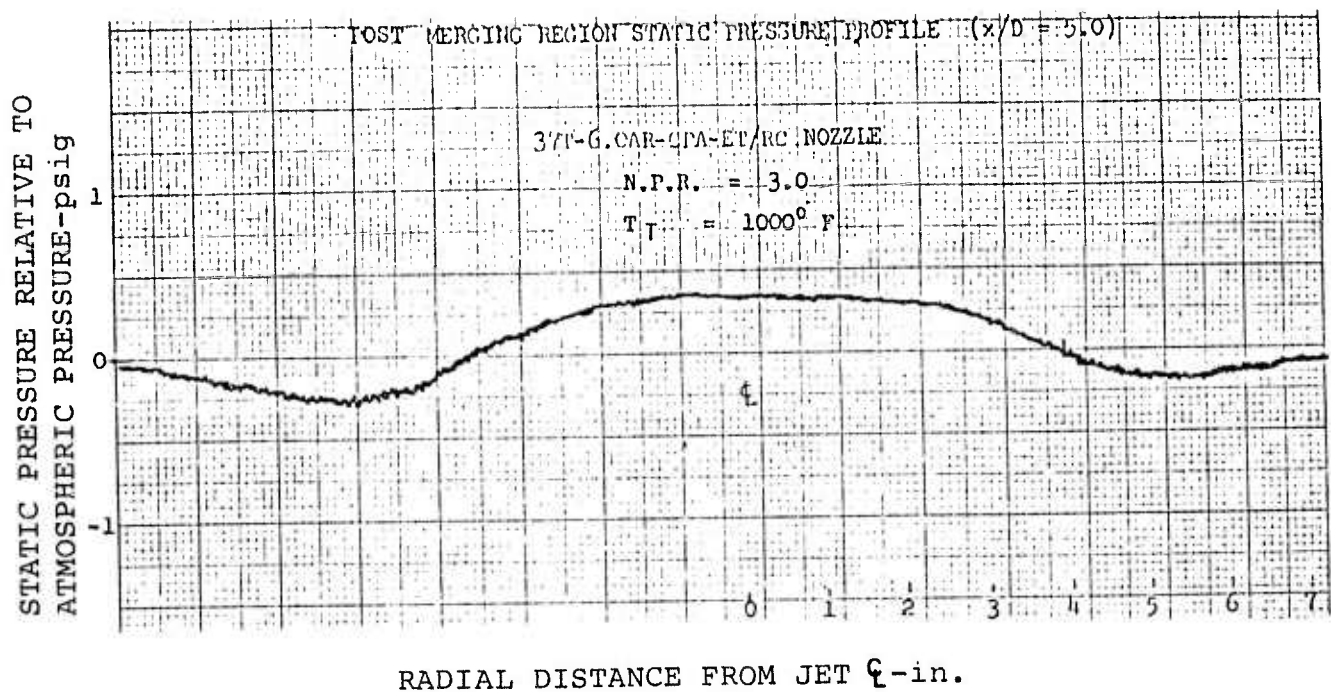


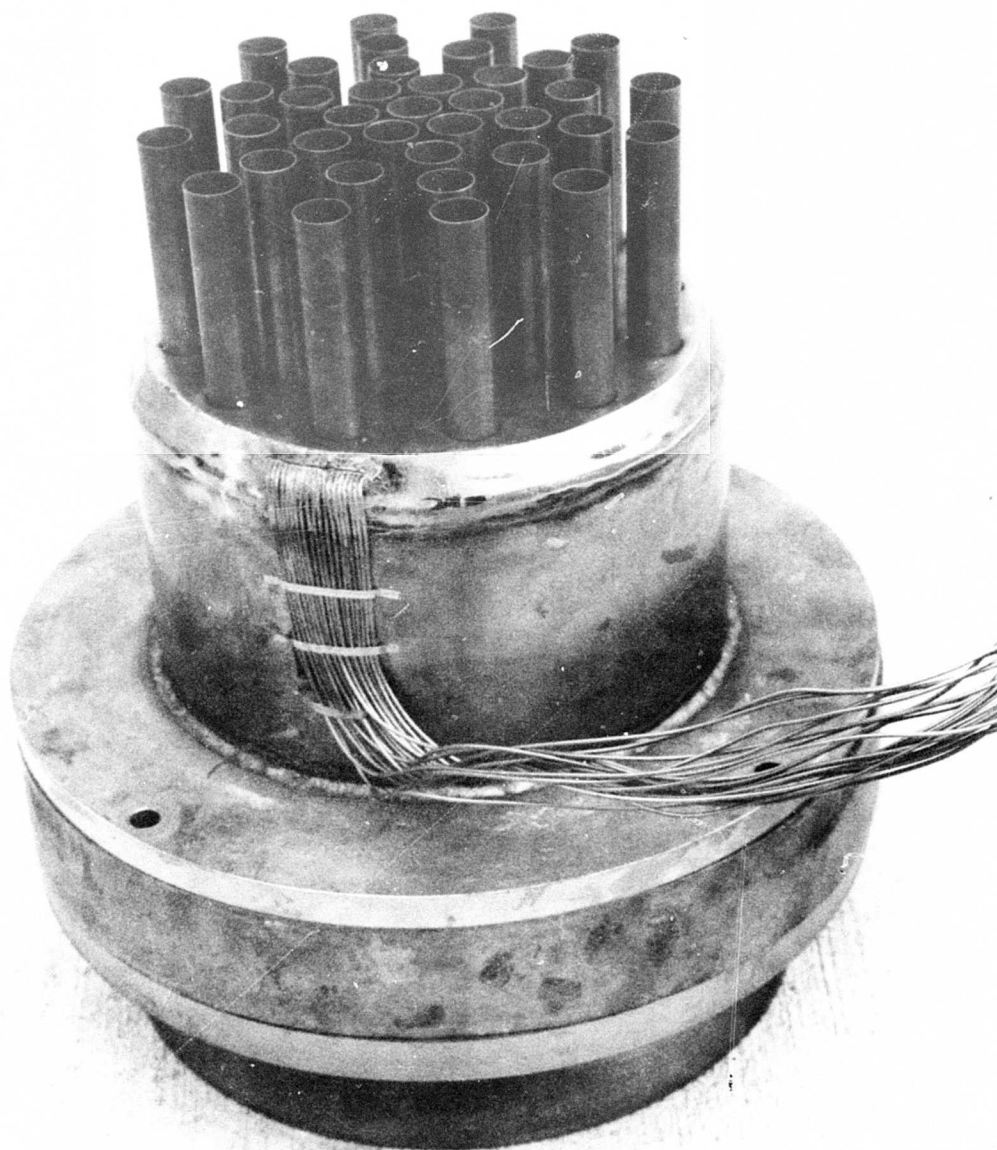




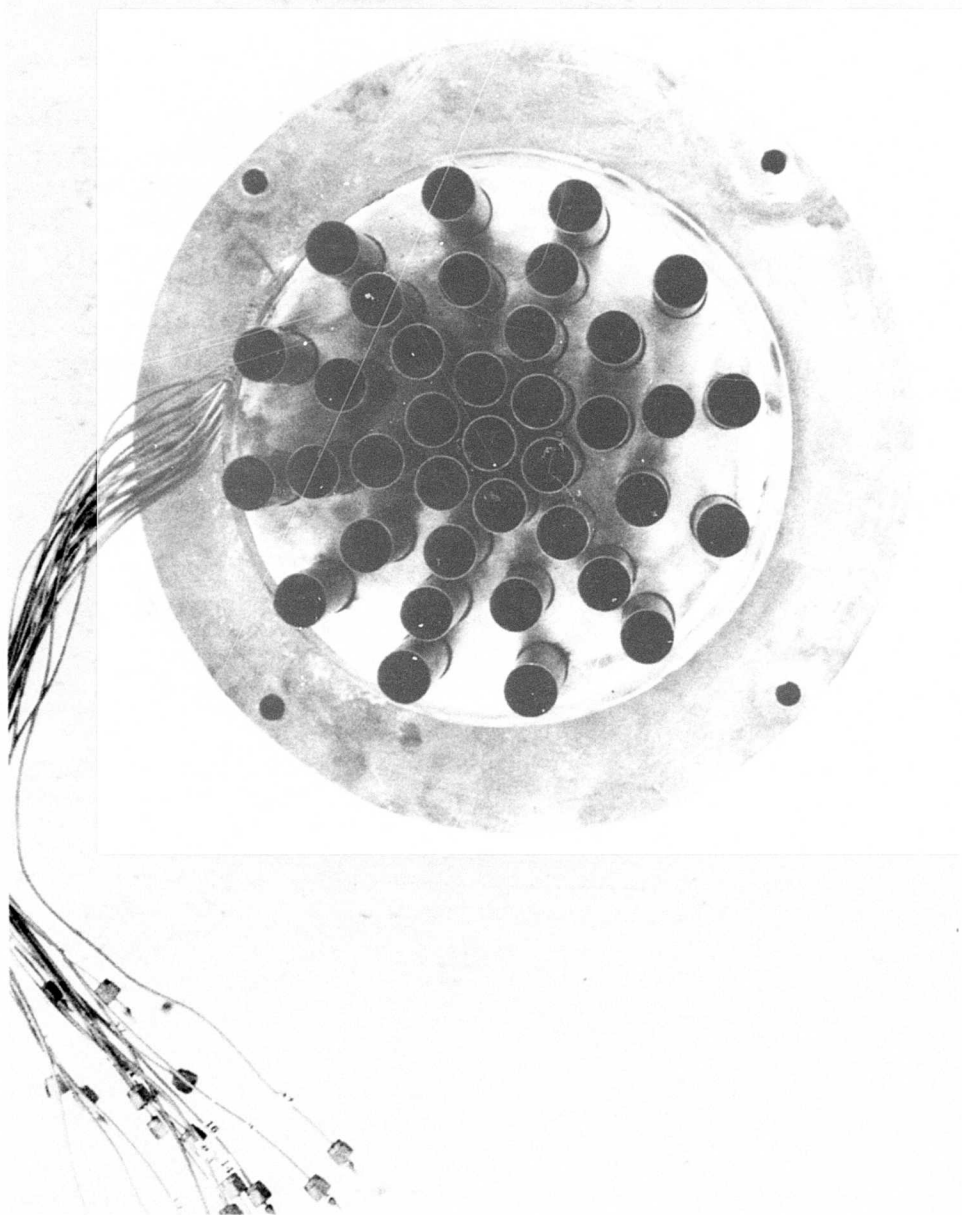


RADIAL DISTANCE FROM JET ζ -in.





37T-3.3AR-RA-RT/NC NOZZLE



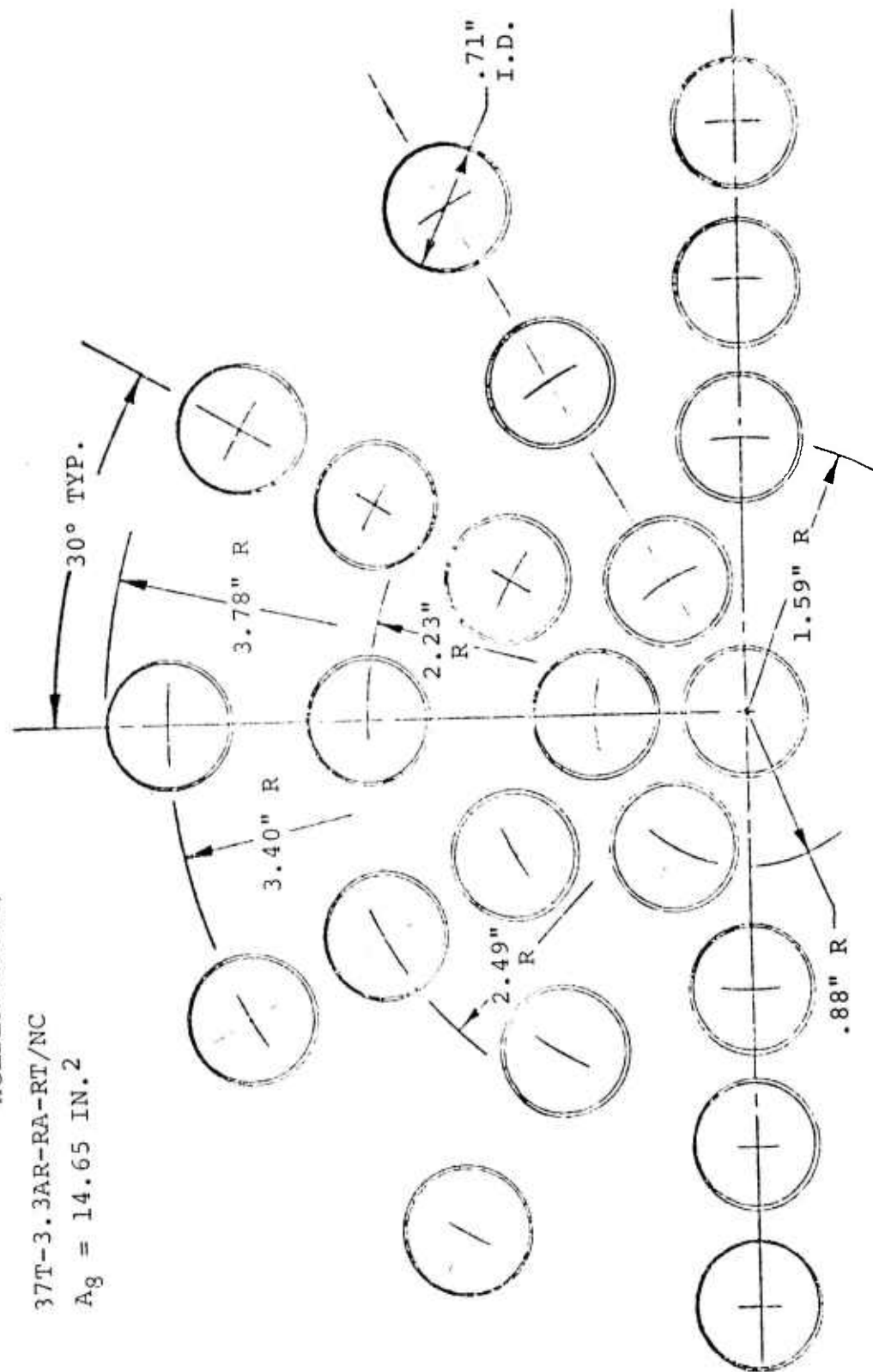
37T-3.3AR-RA-RT/NC NOZZLE

MAR'L-.75" DIA. .020 WALL

TUBE LENGTH = 6.0" (EXIT PLANE TO TUBE
HOLDER PLATE)

37T-3.3AR-RA-RT/NC

$A_g = 14.65 \text{ IN.}^2$



37 TUBE - AREA RATIO 3.3 STRAIGHT TUBES RADIAL ARRAY

TEST CONDITIONS

NOZZLE: 37T-3.3AR-RA-ET/NC

FACILITY: HNTF

DATE: 6-11-73

T_{AMB} = 68°F

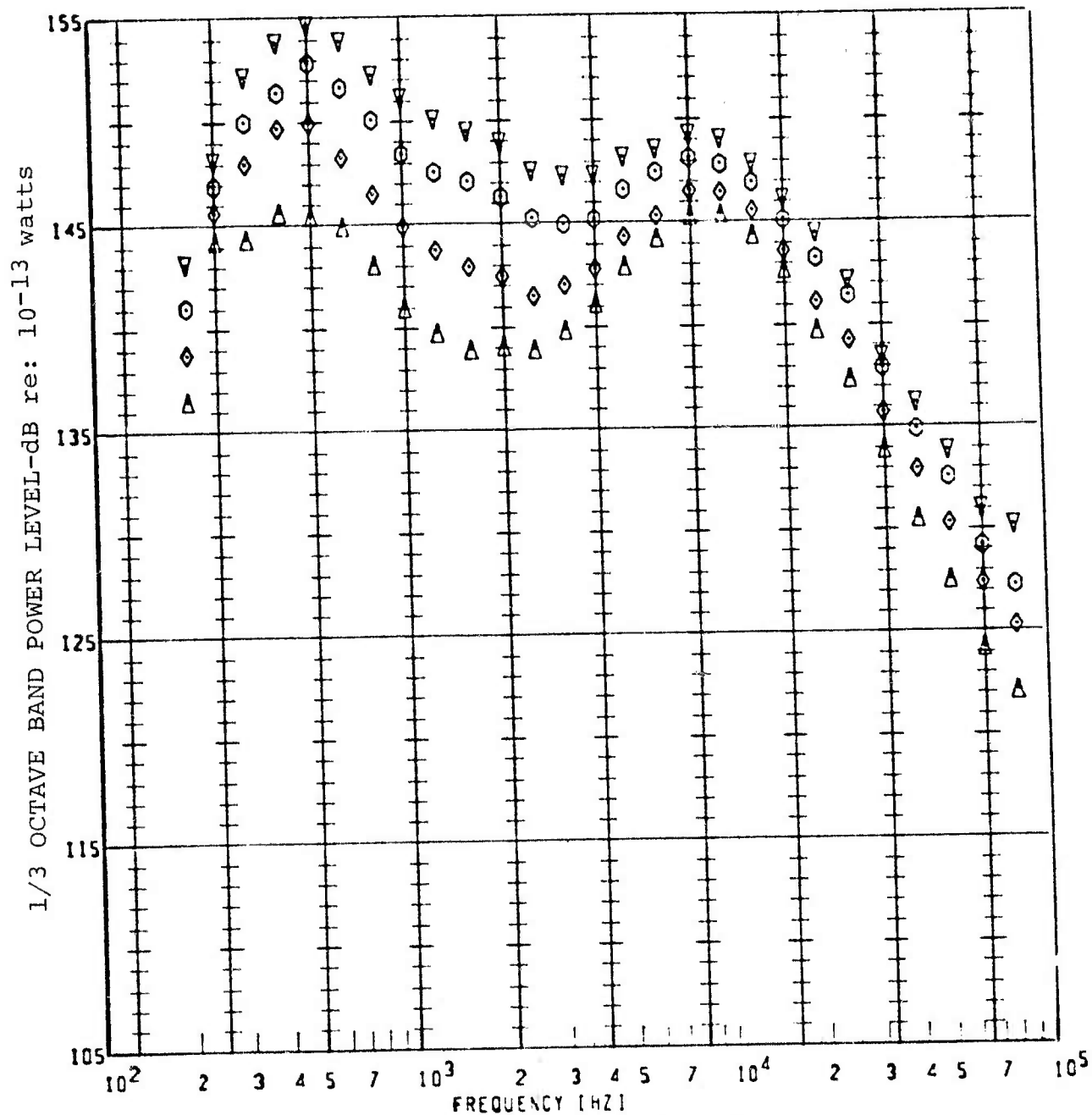
R.H. = 58%

SCALE MODEL $A_8 = 14.65 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
10	2.0	1150°F	1875 fps	6" tube lengths	
"	2.5	"	2126	" "	
"	3.0	"	2303	" "	
"	3.5	"	2437	" "	
"	4.0	"	2544	" "	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

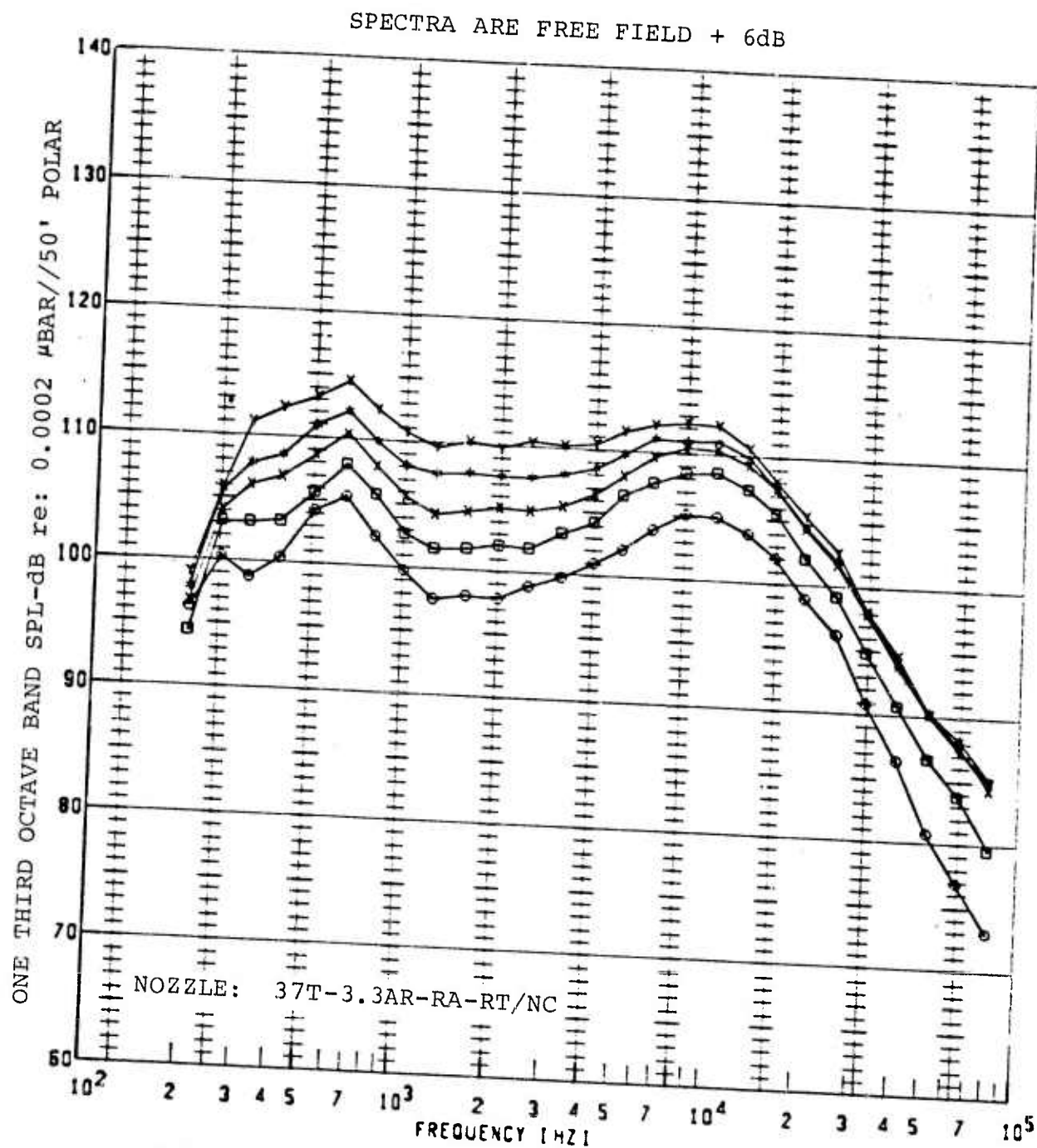
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	010	2.50	1150°F
◆	010	3.00	1150
○	010	3.50	1150
▼	010	4.00	1150

NOZZLE: 37T-3.3AR-RA-RT/NC

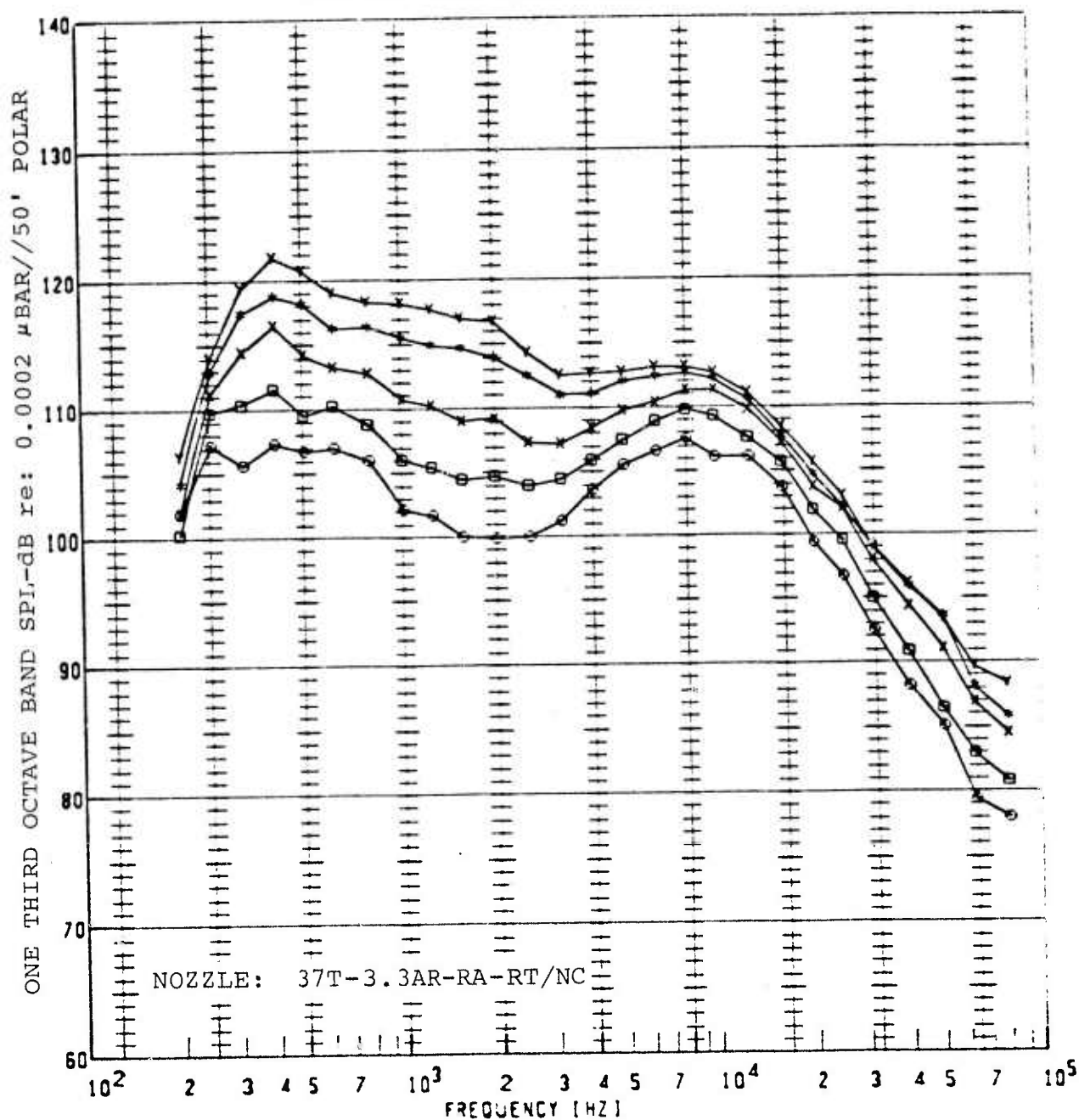
JET NOISE POWER SPECTRA



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE 34" TO	ANGLE RE INLET	OBSERVER LOCATION	DASPL (dB)
○	0106	1150° F	2.000	110° ↓	50FP	115.2
□	0105	1150	2.500		50FP	118.4
x	0106	1150	3.000		50FP	120.7
*	0106	1150	3.500		50FP	122.2
Δ	0106	1150	4.000		50FP	124.2

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

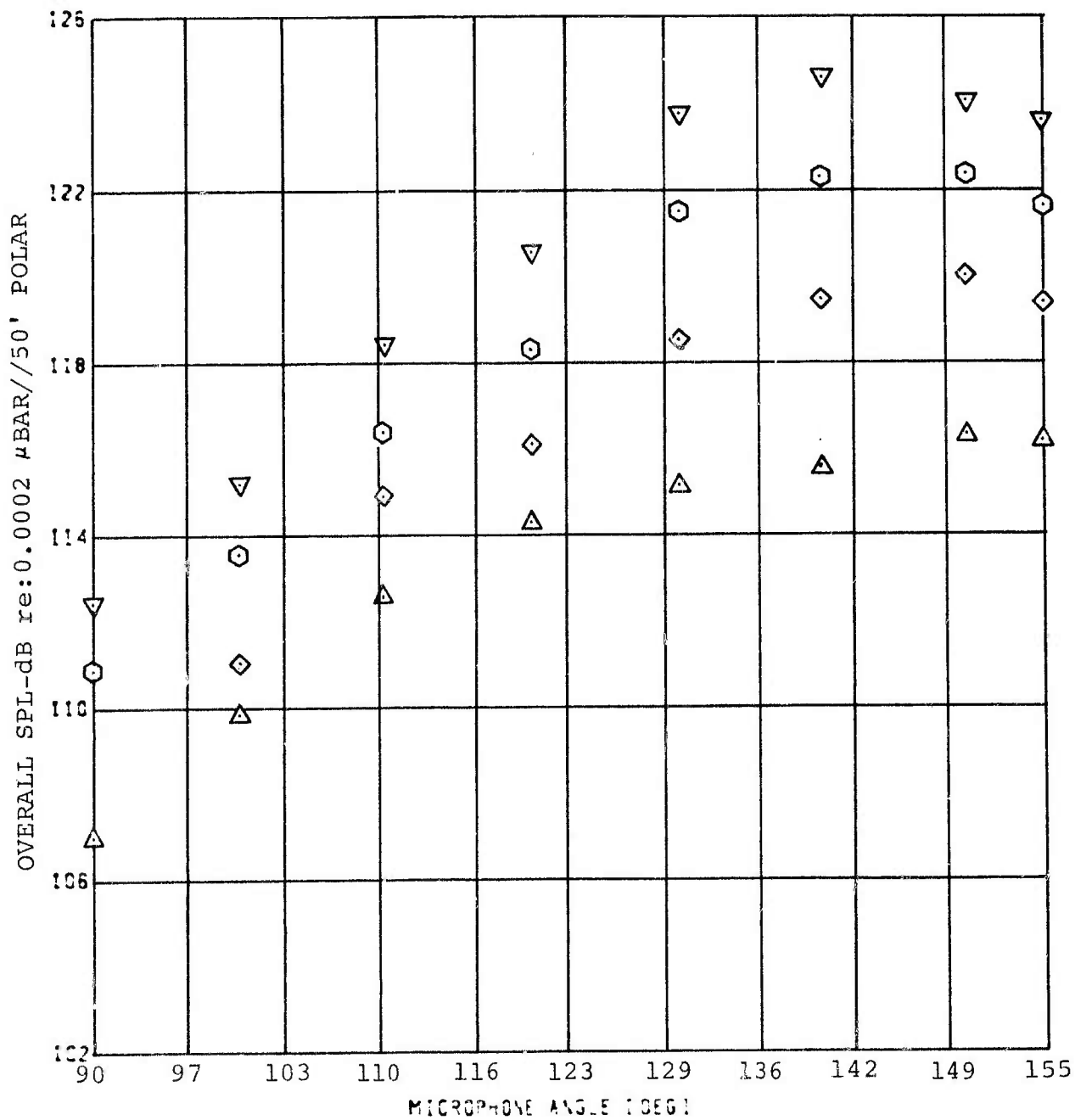
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
○	0106	1150°F	2.000	130°	50FP	118.1
□	0105	1150	2.500	↓	50FP	121.1
x	0106	1150	3.000	↓	50FP	124.4
*	0106	1150	3.500	↓	50FP	127.5
y	0106	1150	4.000	↓	50FP	129.6

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

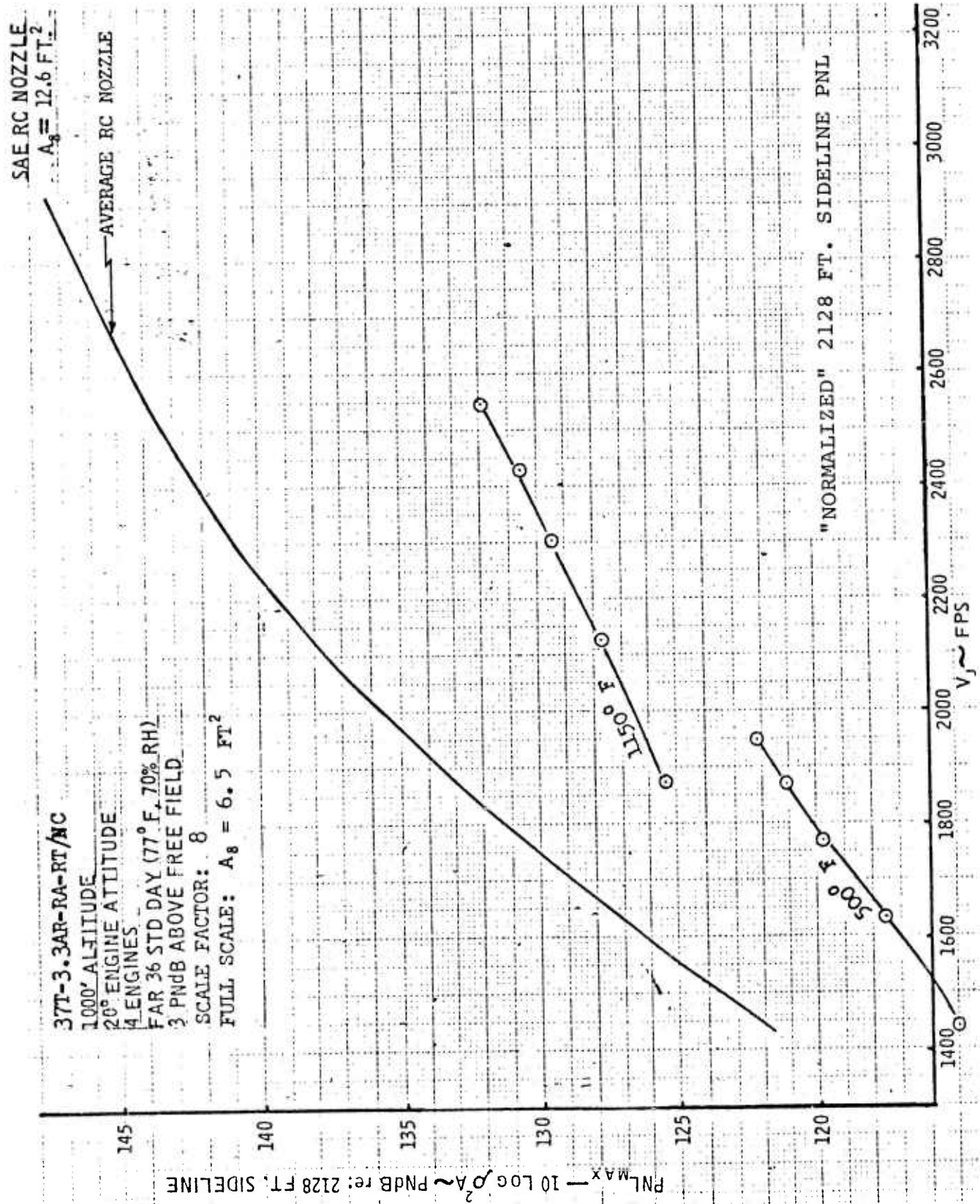
FREE FIELD VALUES

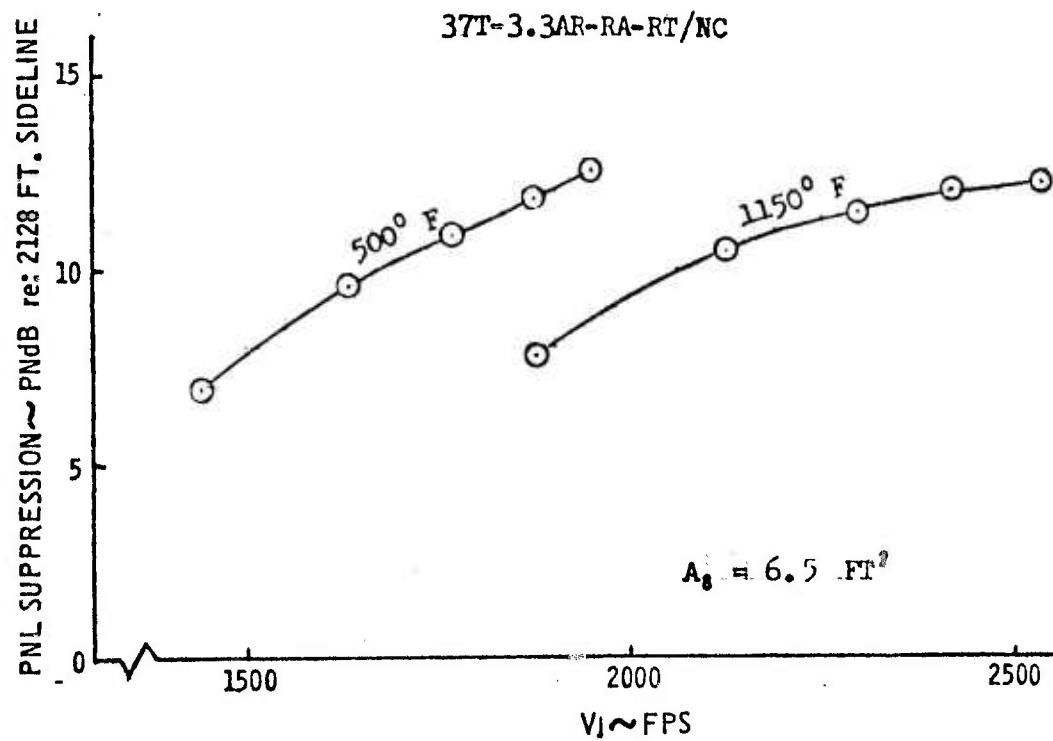


PLST SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
A	010	2.50	1150°F
O	010	3.00	1150
C	010	3.50	1150
V	010	4.00	1150

NOZZLE: 37T-3.3AR-RA-RT/NC

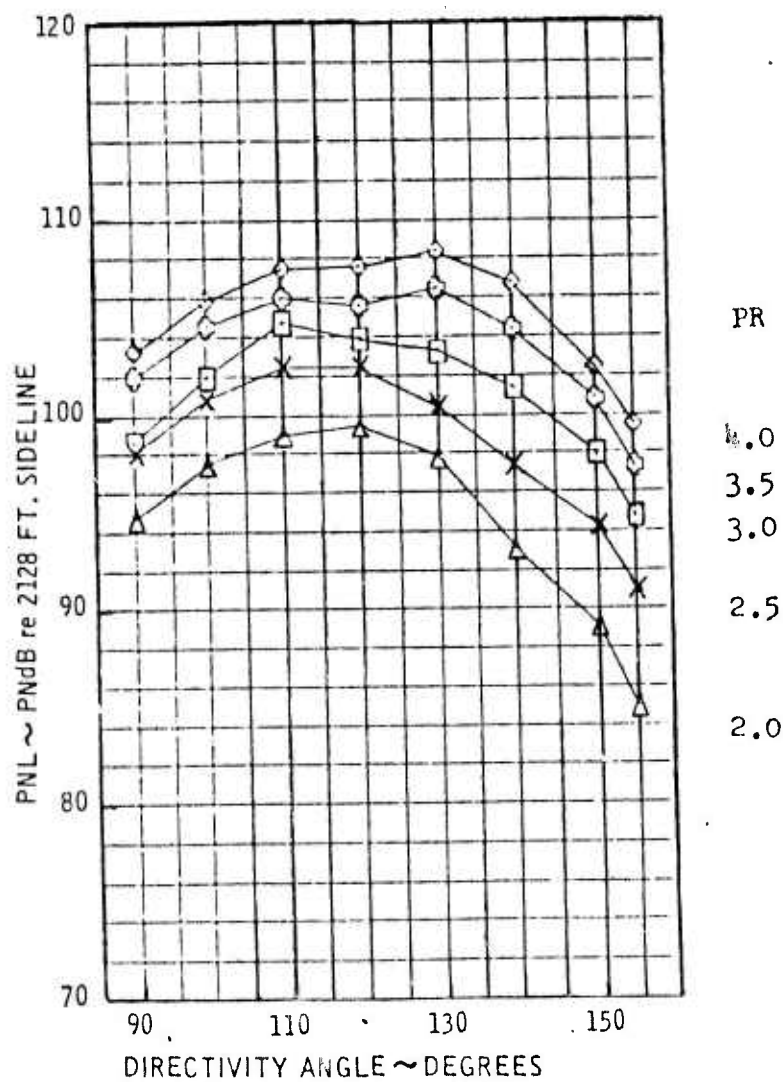
OASPL BEAM PATTERNS





PEAK PNL SUPPRESSION VALUES

NOZZLE: 37T-3.3AR-RA-RT/MC

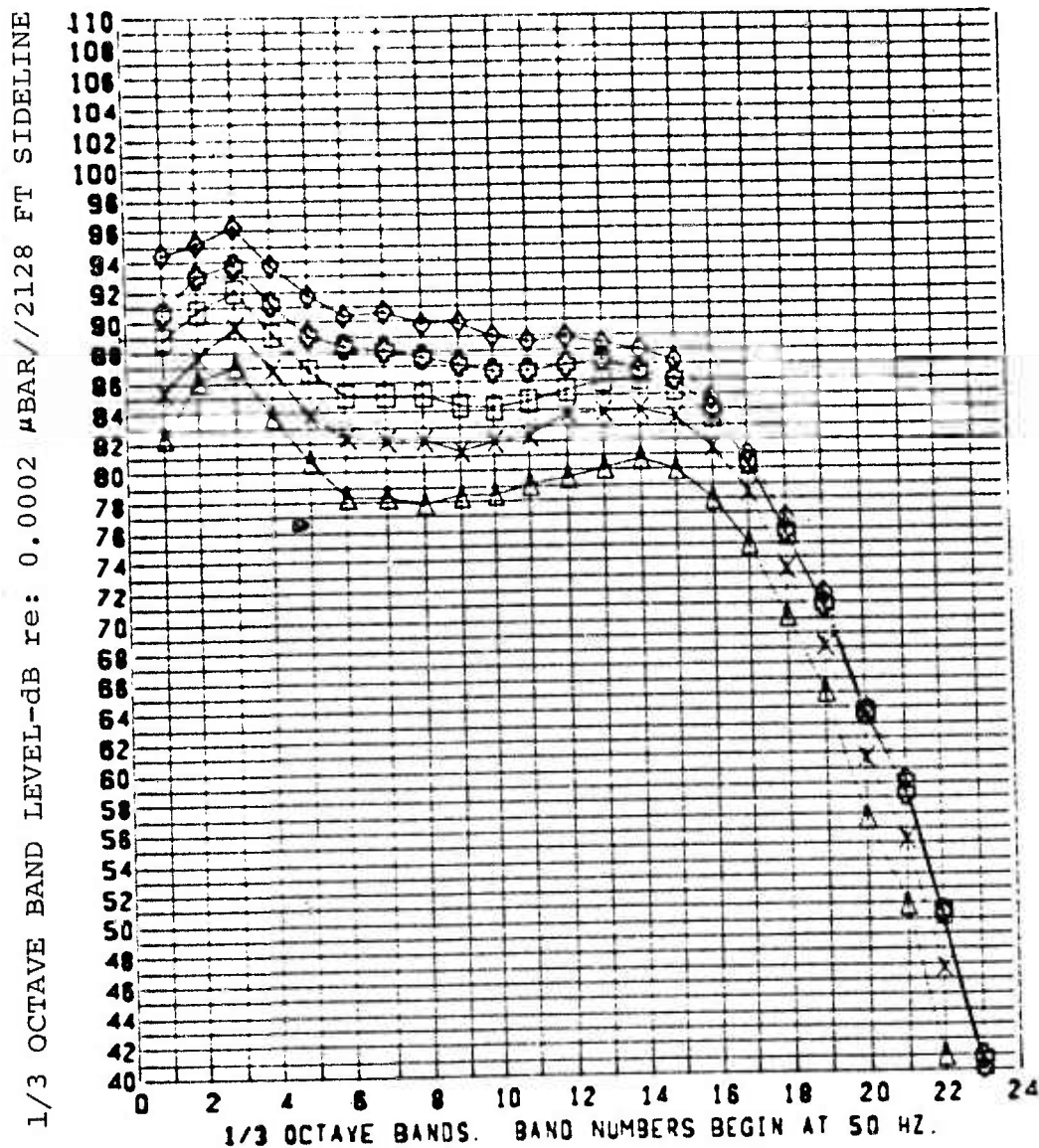


RUN 010
 $T_T = 1150^{\circ} F$ $A_8 = 6.5 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



TT = 1150°F A8 = 6.05 FT² RUN:010

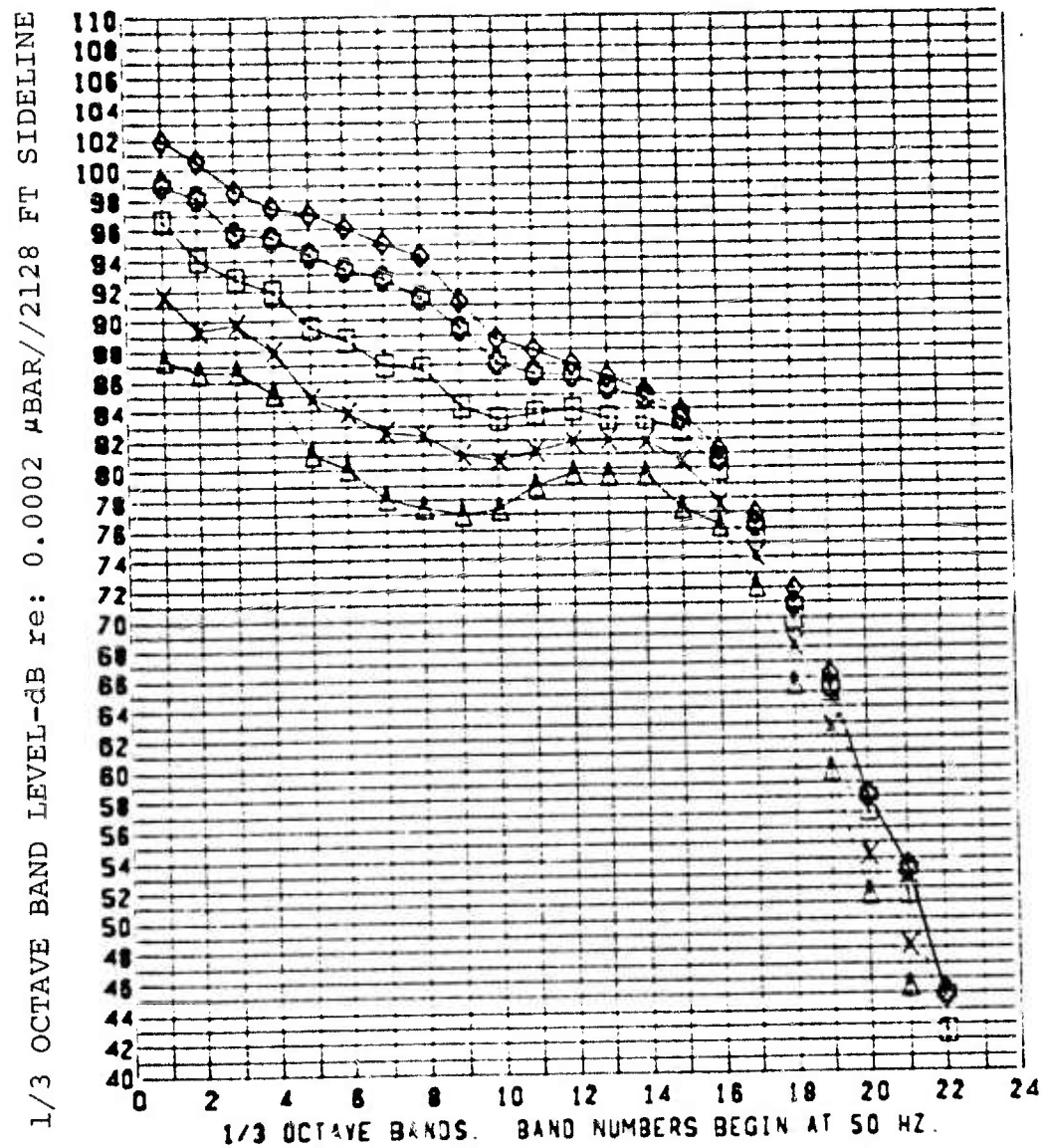
PR = Δ 2.0, X 2.5, □ 3.0, + 3.5, ◇ 4.0

NOZZLE: 37T-3.3AR-RA-RT/NC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



$T_t = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 010

PR = Δ 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7

NOZZLE: 37T-3.3AR-RA-RT/NC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-3.3AR-RA-RT/NC

FACILITY: WALL ISOLATION FACILITY

DATE: January 20, 1973

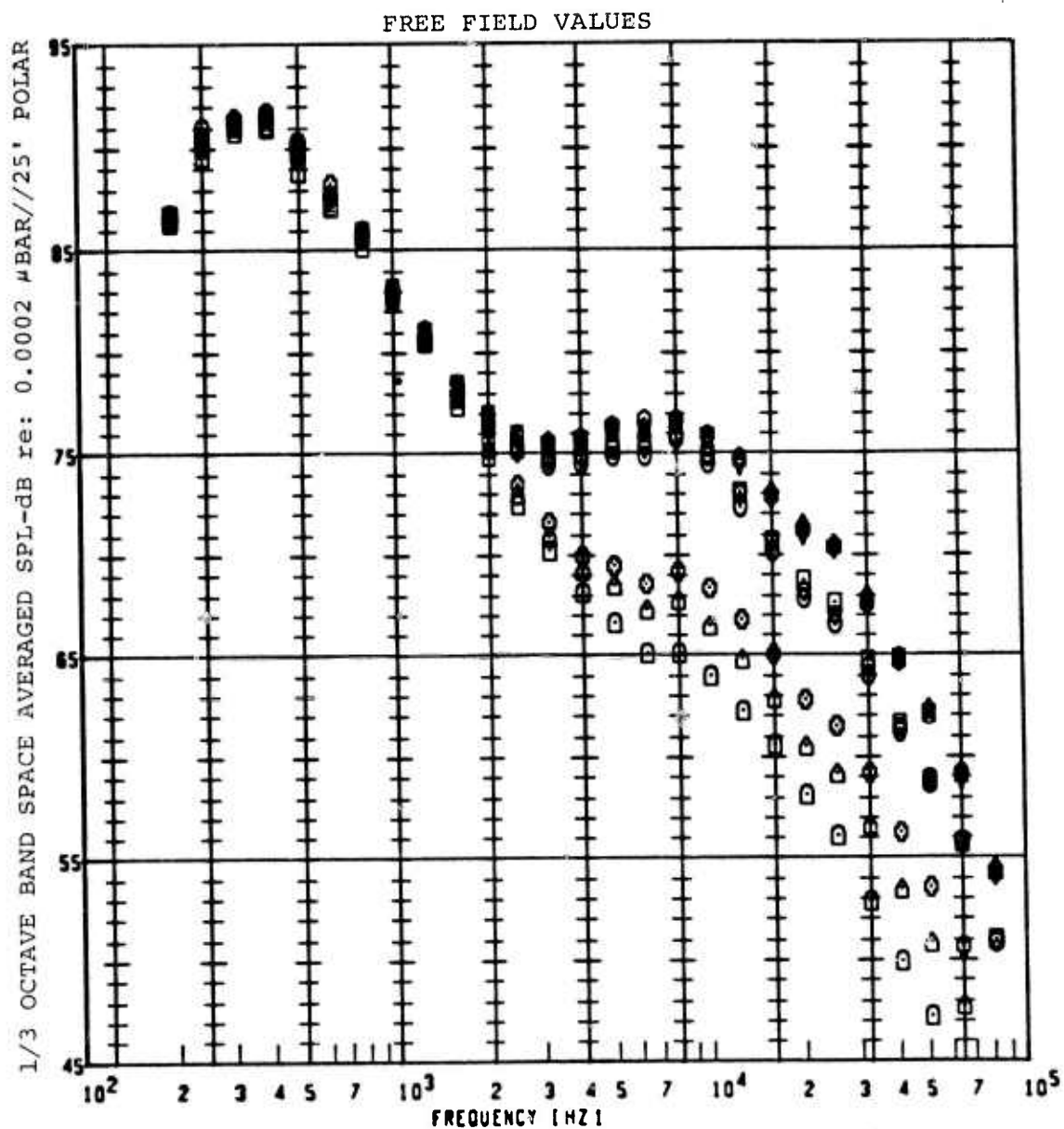
P_{AMB} = 30.06 in Hg **T_{AMB}** = 41°F **R.H.** = 85%

NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
146	0.0 x/D	9.0 in.		
147	0.25	9.0		
148	0.50	9.0		
149	0.75	10.0		
150	1.00	14.0		
151	1.25	10.5		
152	1.50	10.5		
153	1.75	11.0		
154	2.00	11.0		
155	2.25	11.5		
156	2.50	11.5		
157	2.75	12.0		
158	3.0	13.0		
159	3.5	14.0		
160	4.0	15.0		
161	5.0	16.0		
162	6.0	18.0		
163	8.0	19.0		
164	10.0	21.0		
165	12.0	23.0		
166	14.0	35.0		
167	16.0	27.0		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC



PLOT
SYMBOL

RUN
NUMBER

JET
TEMP
 $^{\circ}$ F

PRESSURE
RATIO

AXIAL
LOCATION, x/D

Δ
 \diamond
 \circ
 ∇
 \square
 \circ
 \circ
 \diamond
 \triangle
 \square

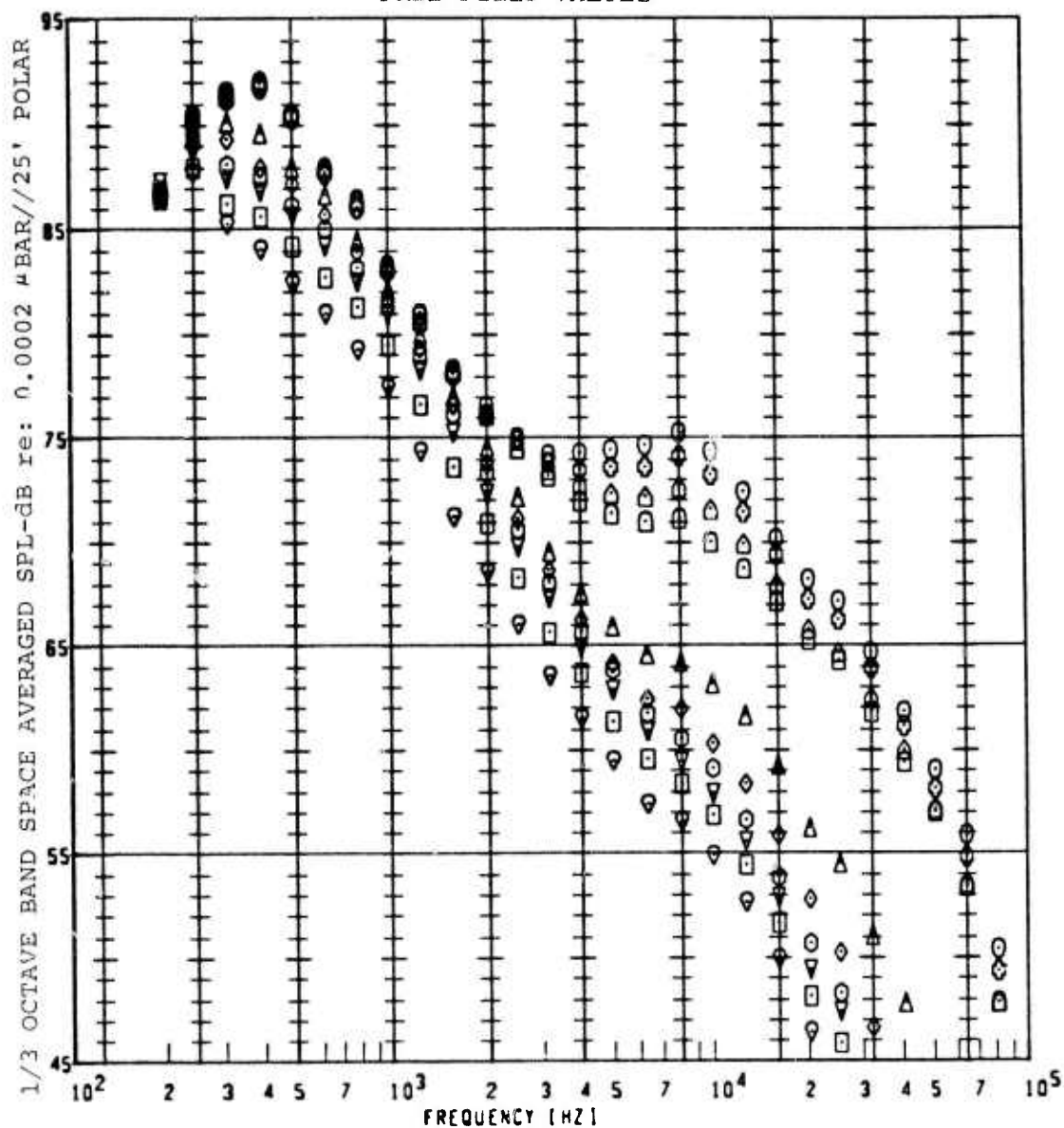
146
147
148
149
150
151
152
153
154
155
156

1150 $^{\circ}$ F
1150
1150
1150
1150
1150
1150
1150
1150
1150
1150

3.000

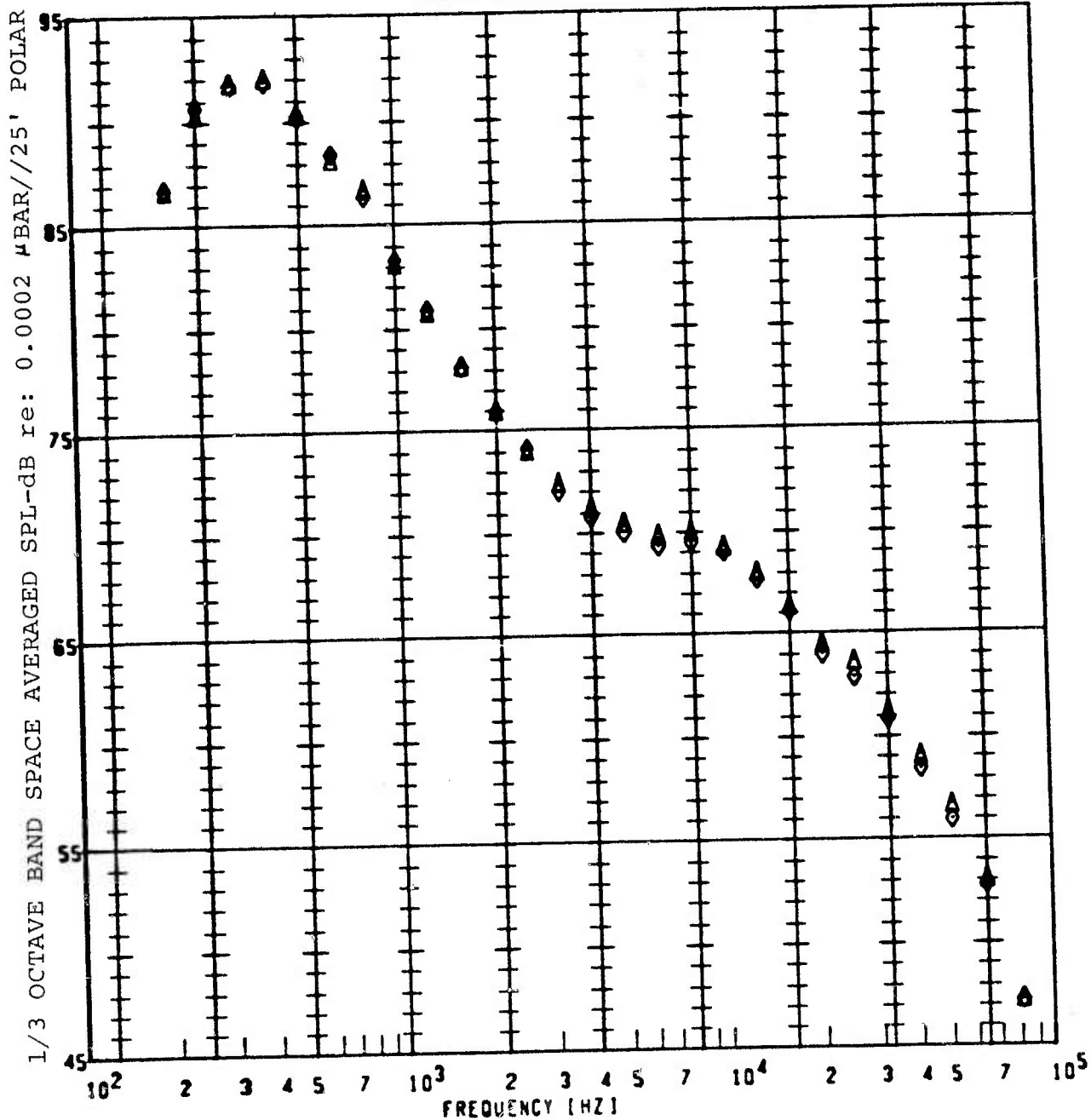
0.00
0.25
0.50
0.75
1.00
1.25
1.50
3.50
4.00
5.00

FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	162	1150°F	3.0	6.00
\diamond	163	1150	3.0	8.00
\circ	164	1150	3.0	10.00
∇	165	1150	3.0	12.00
\square	166	1150	3.0	14.00
\circ	167	1150	3.0	16.00
\circ	153	1150	3.0	1.75
\circ	154	1150	3.0	2.00
\square	155	1150	3.0	2.25
\square	156	1150	3.0	2.50

FREE FIELD VALUES



PLOT
SYMBOL

Δ
◊

RUN
NUMBER

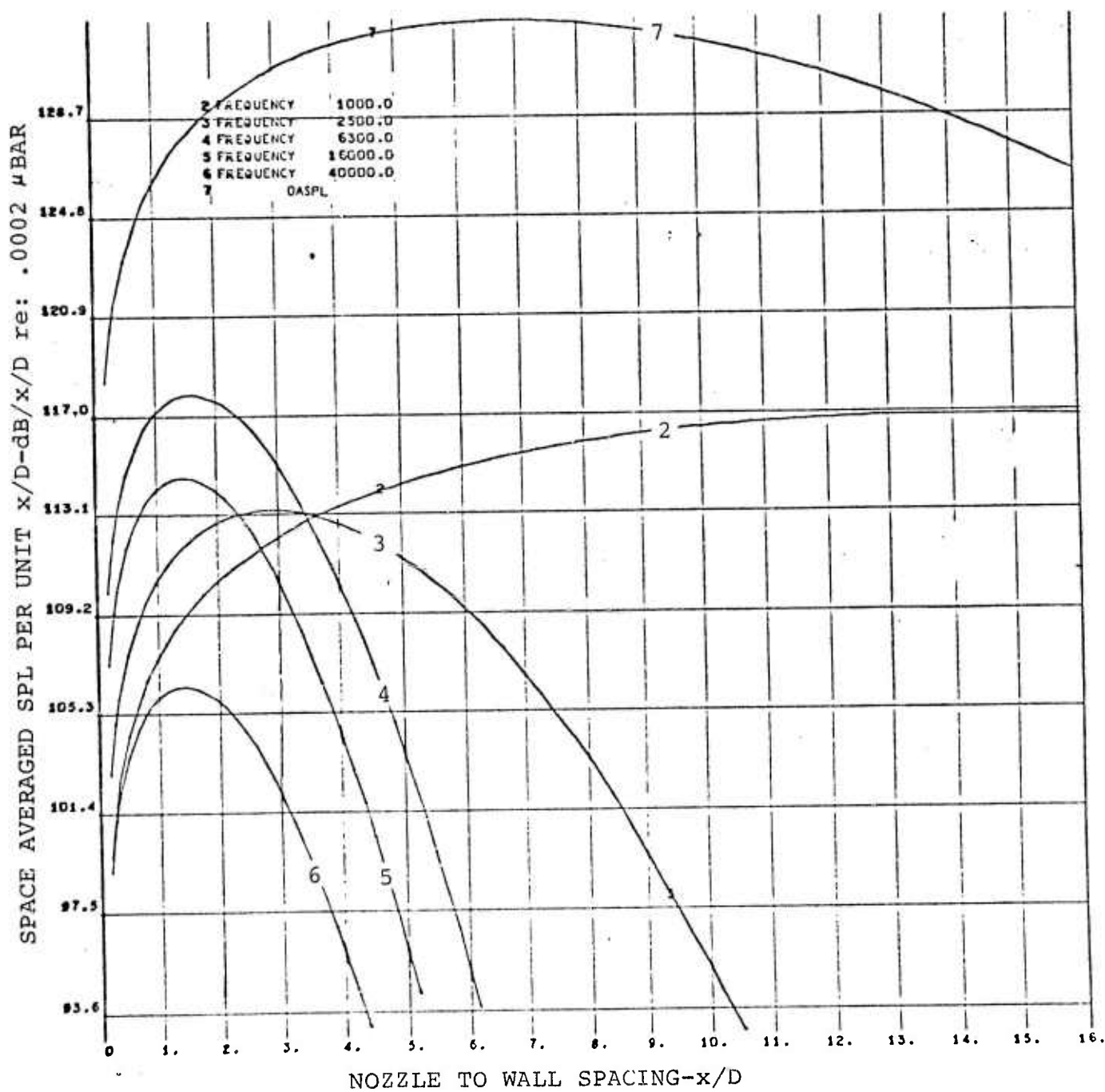
157
158

JET
TEMP

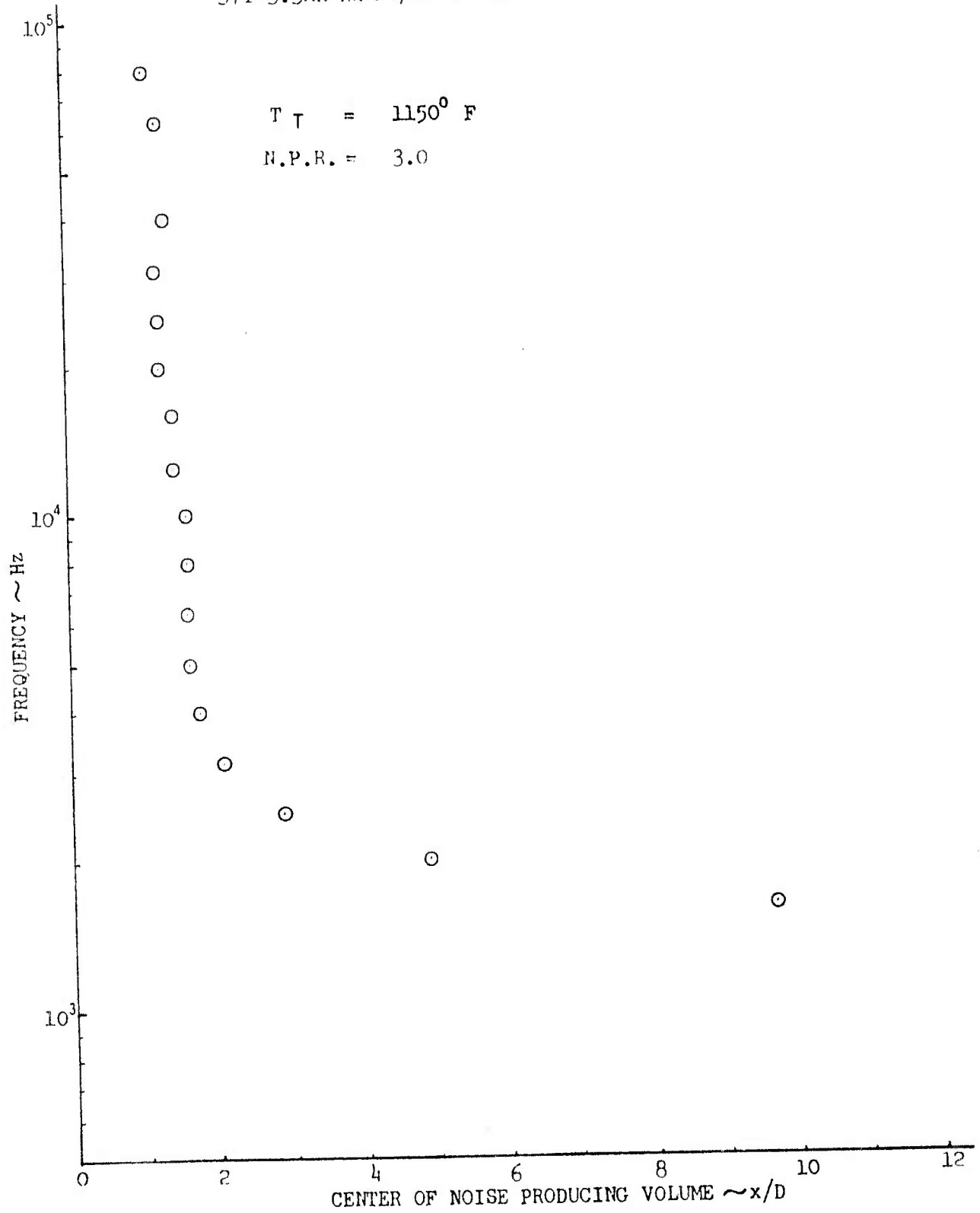
1150°F
1150

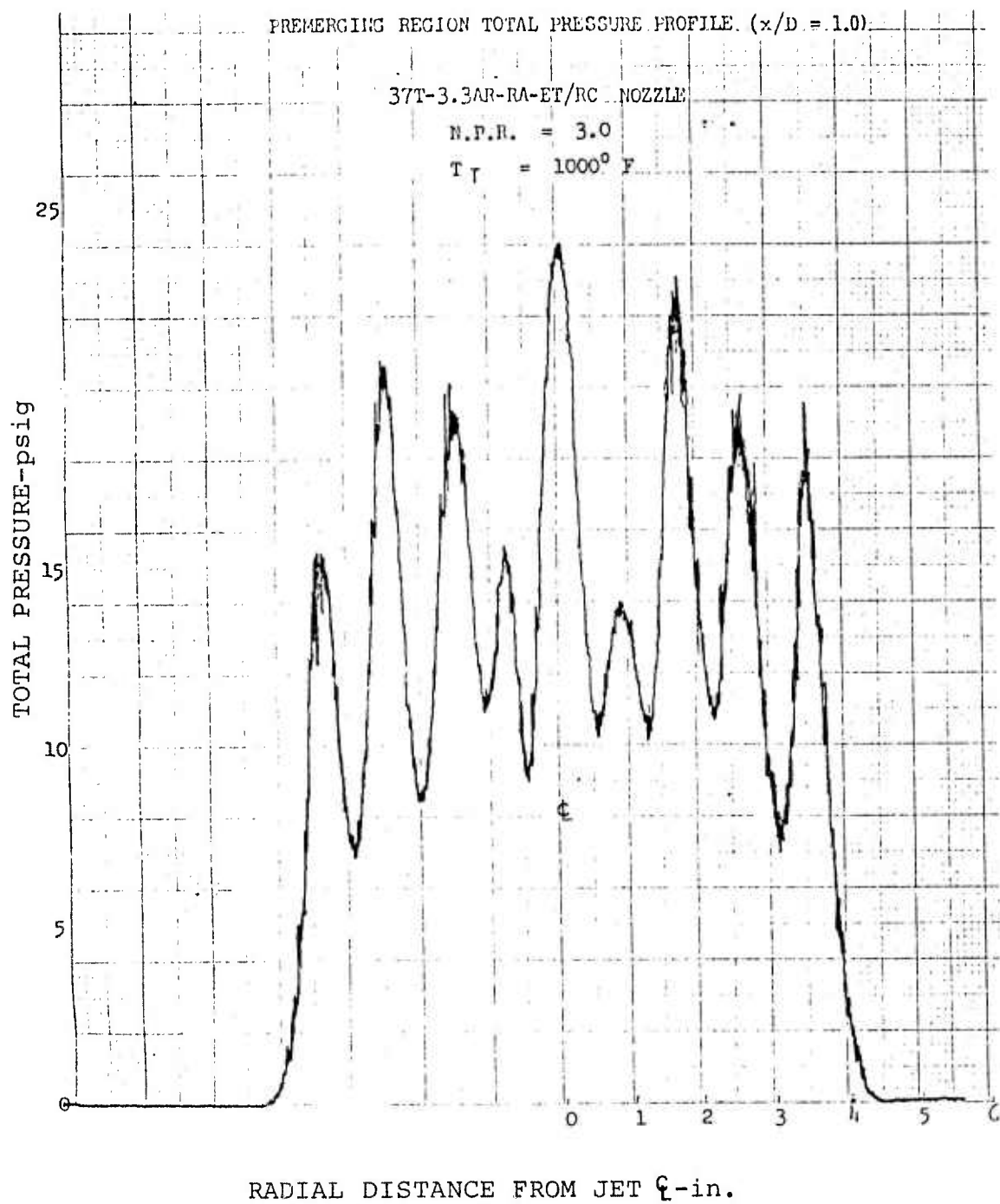
PRESSURE AXIAL
RATIO LOCATION, x/D

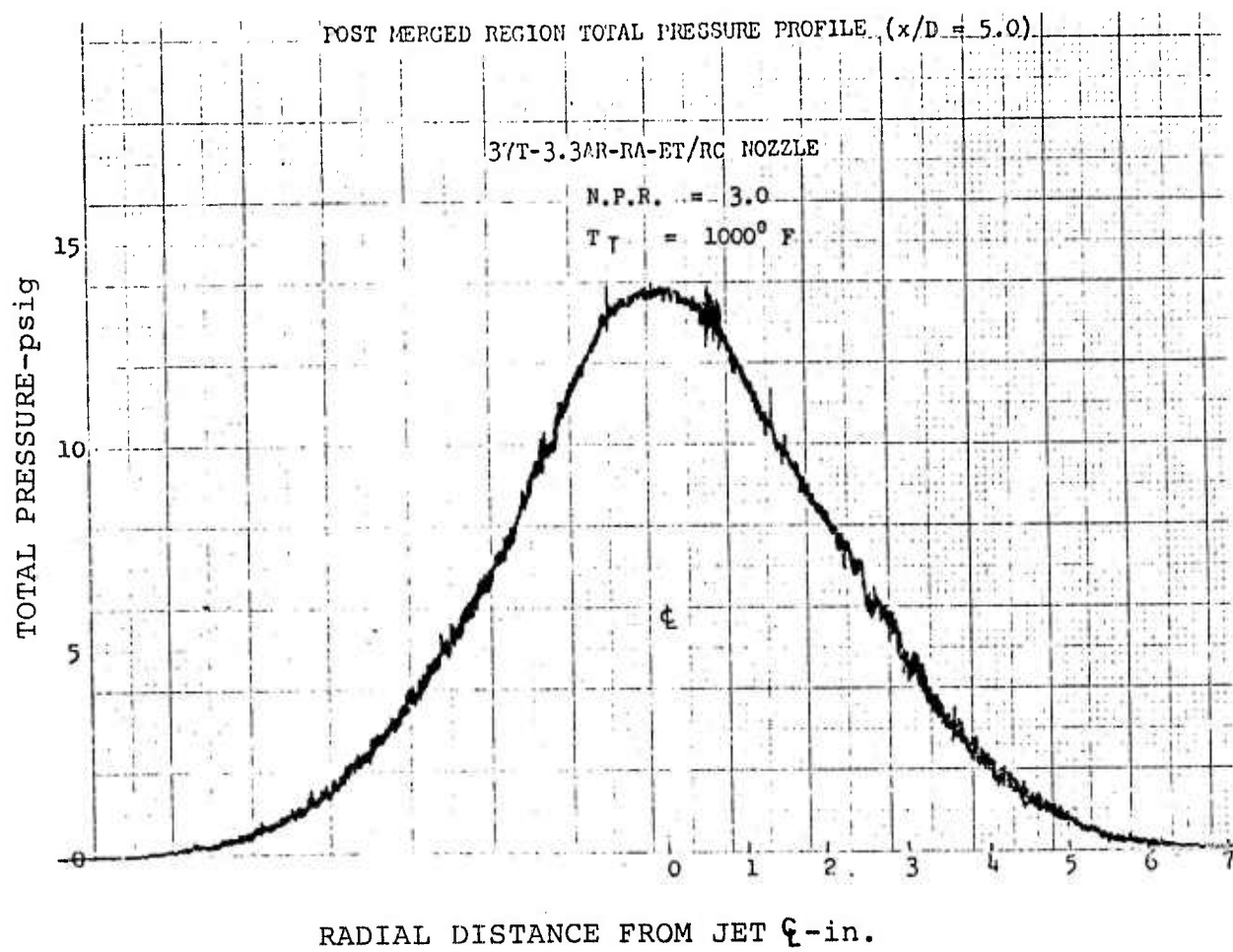
3.000 2.75
3.000 3.00

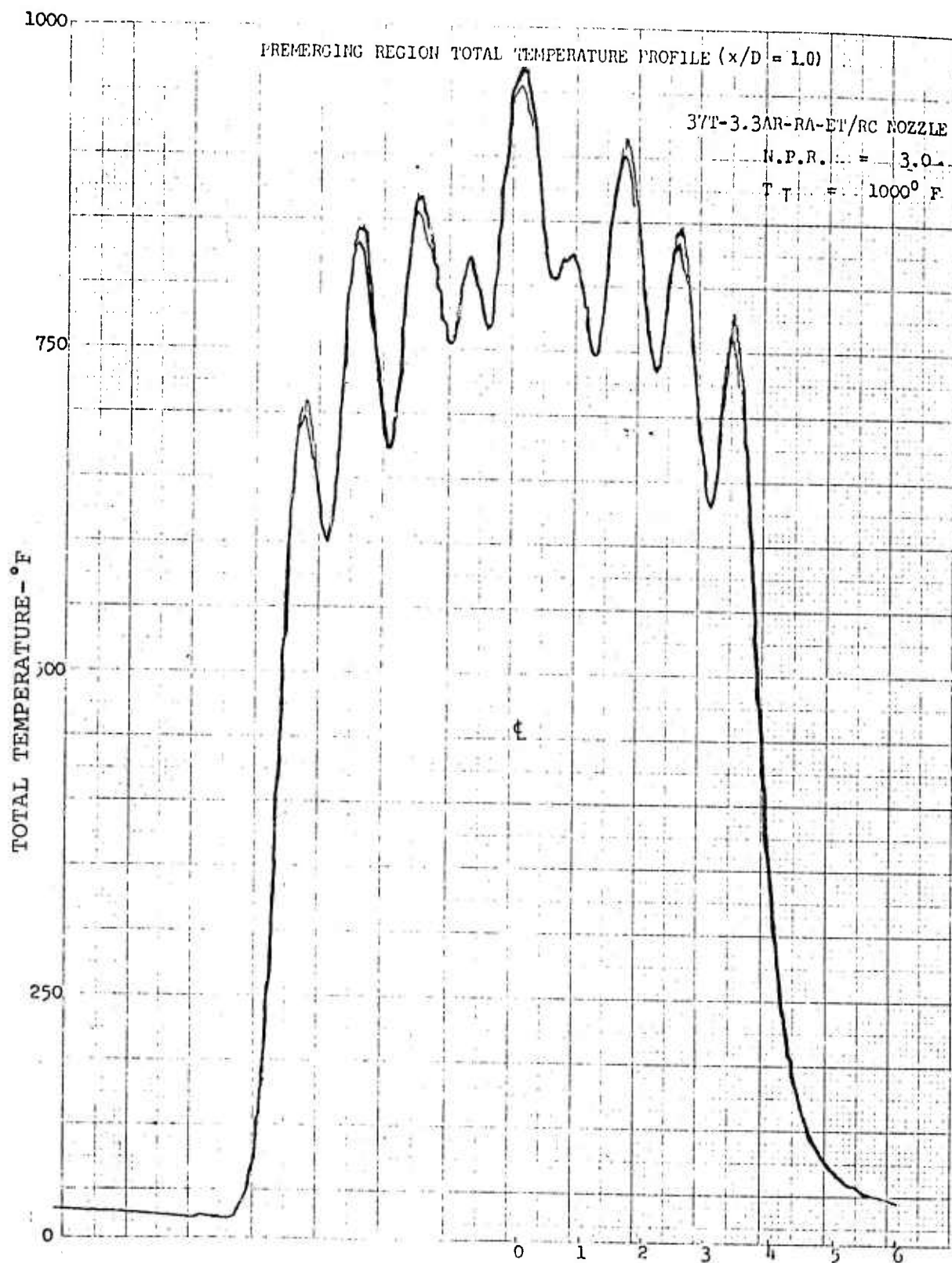


37T-3.3AR-RA-RT/HC NOZZLE

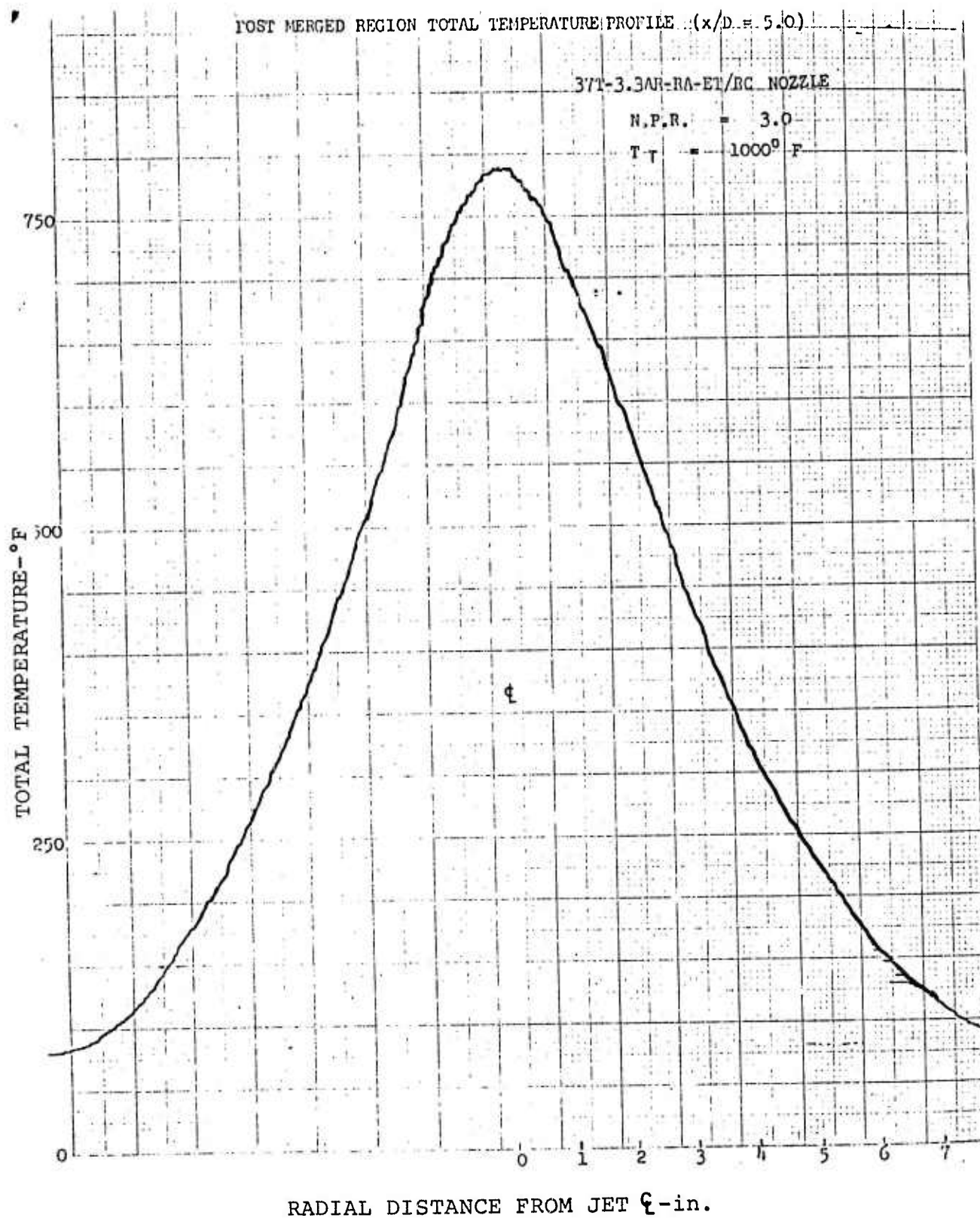


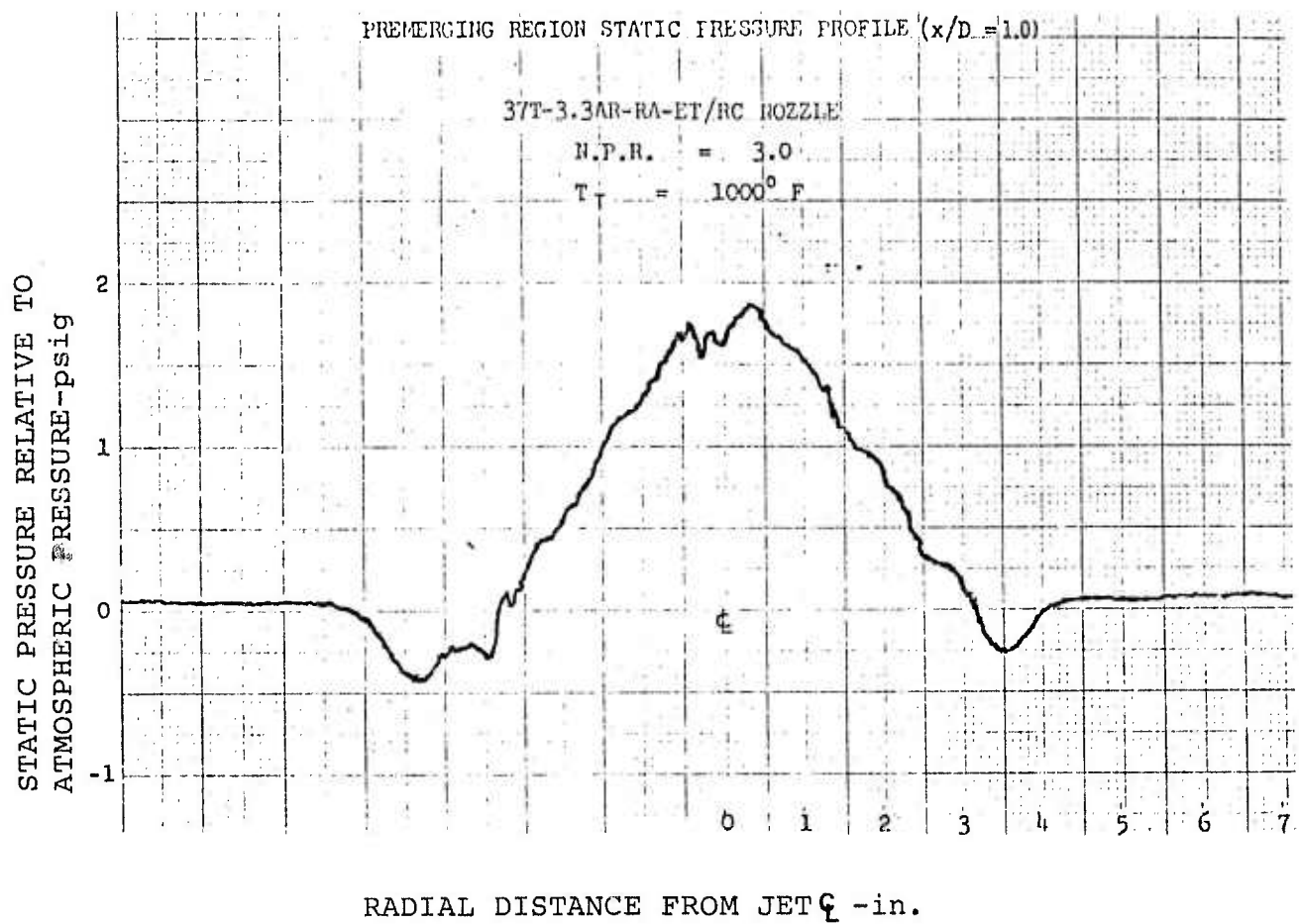


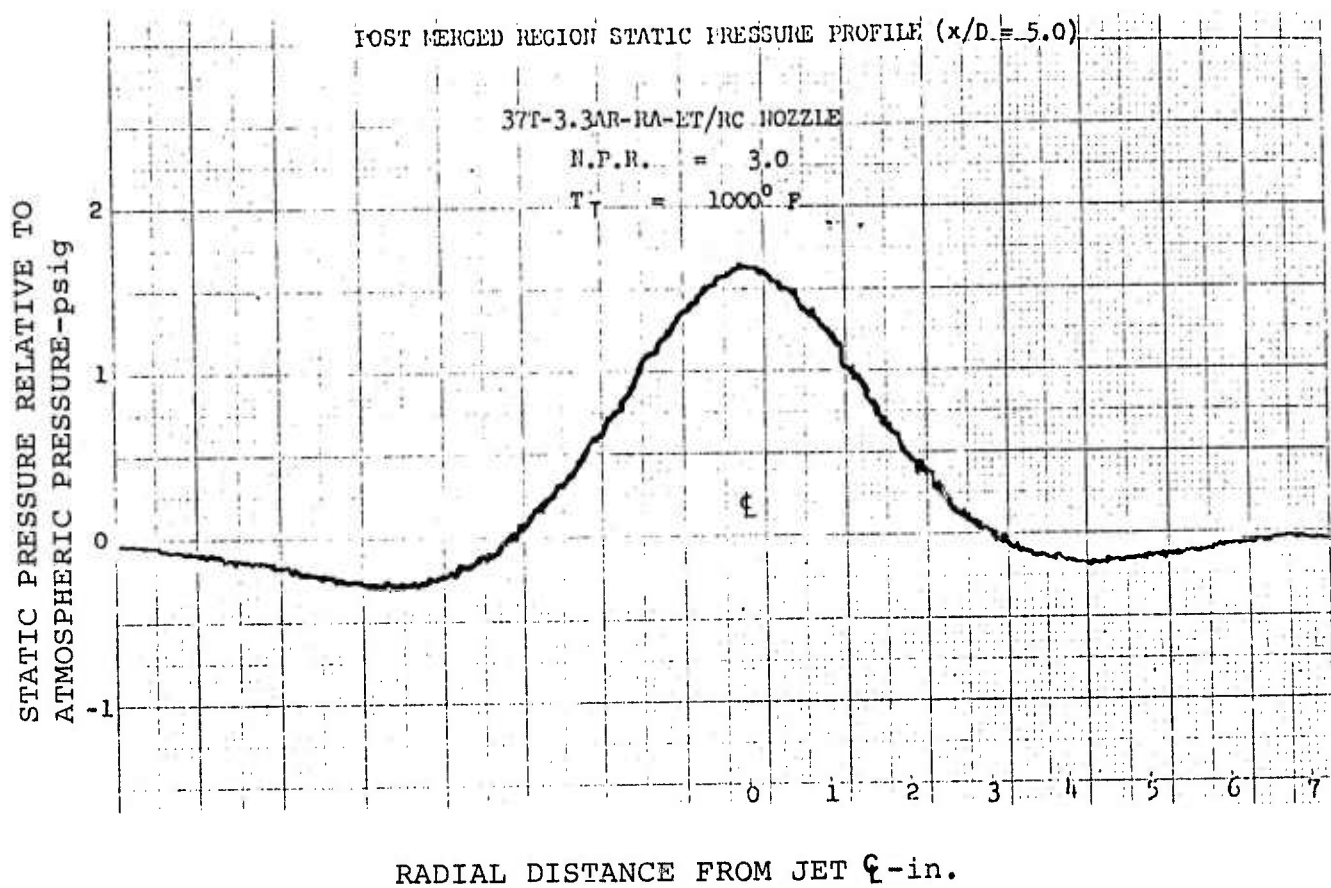


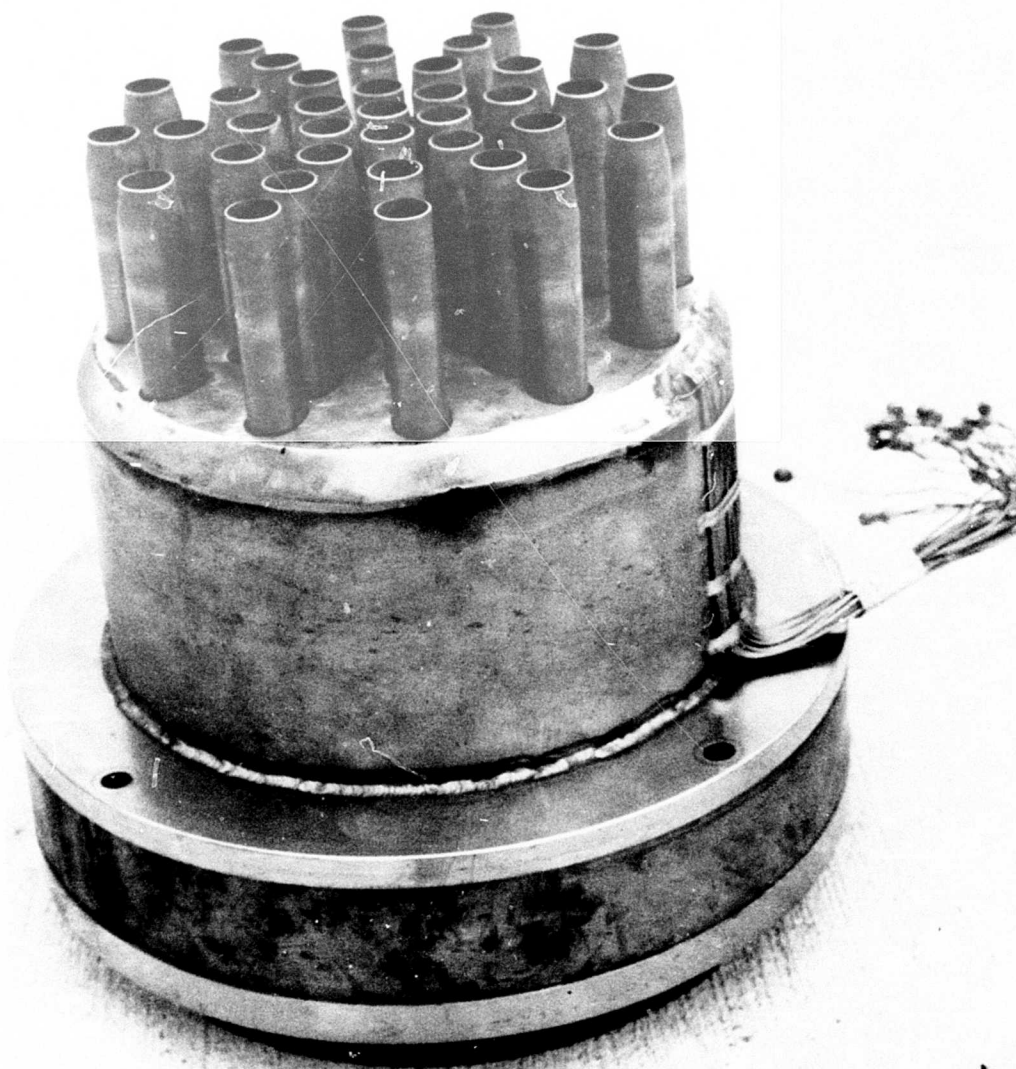


RADIAL DISTANCE FROM JET C-in.

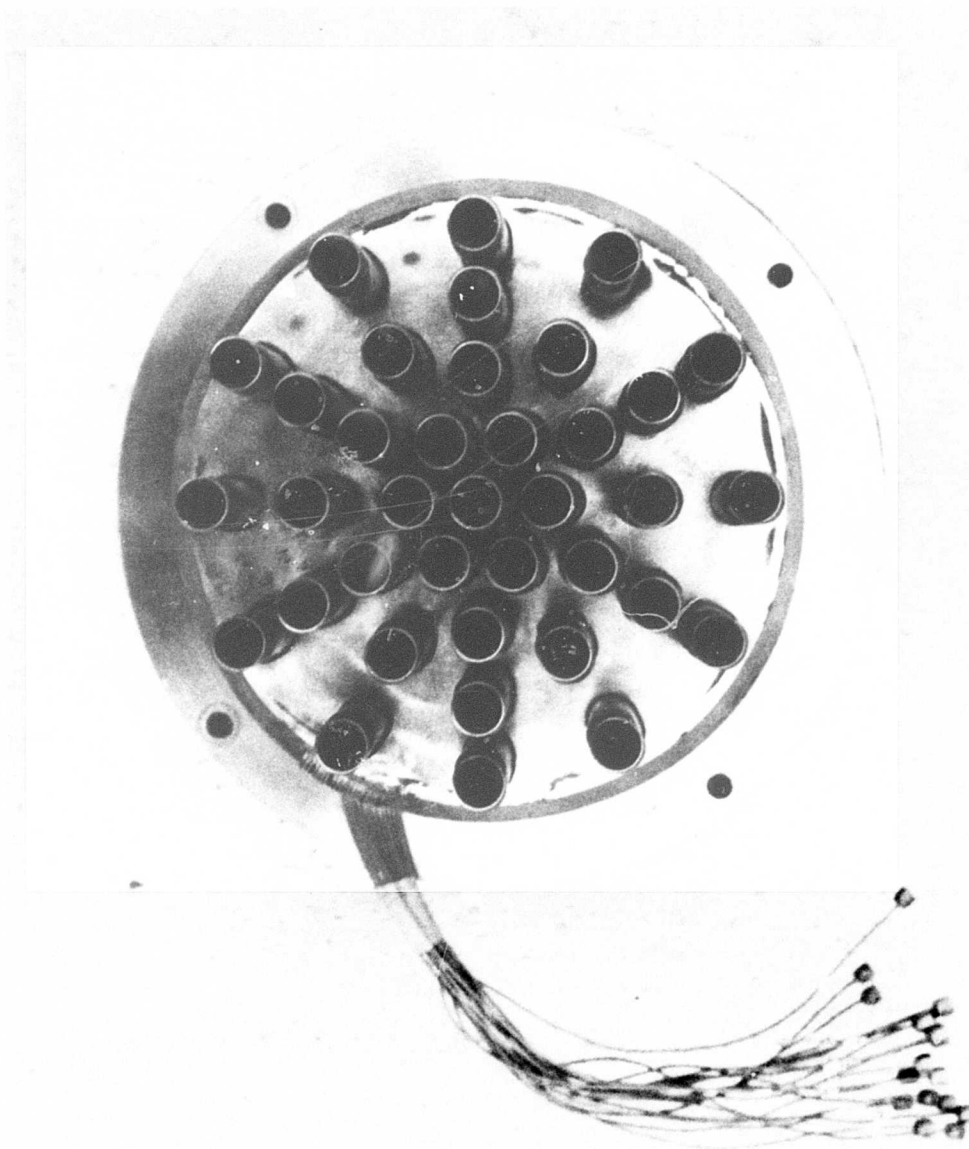






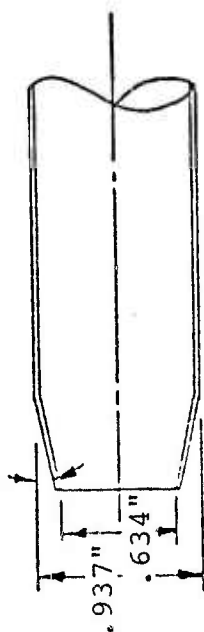


37T-4.5AR-RA-ET/RC NOZZLE



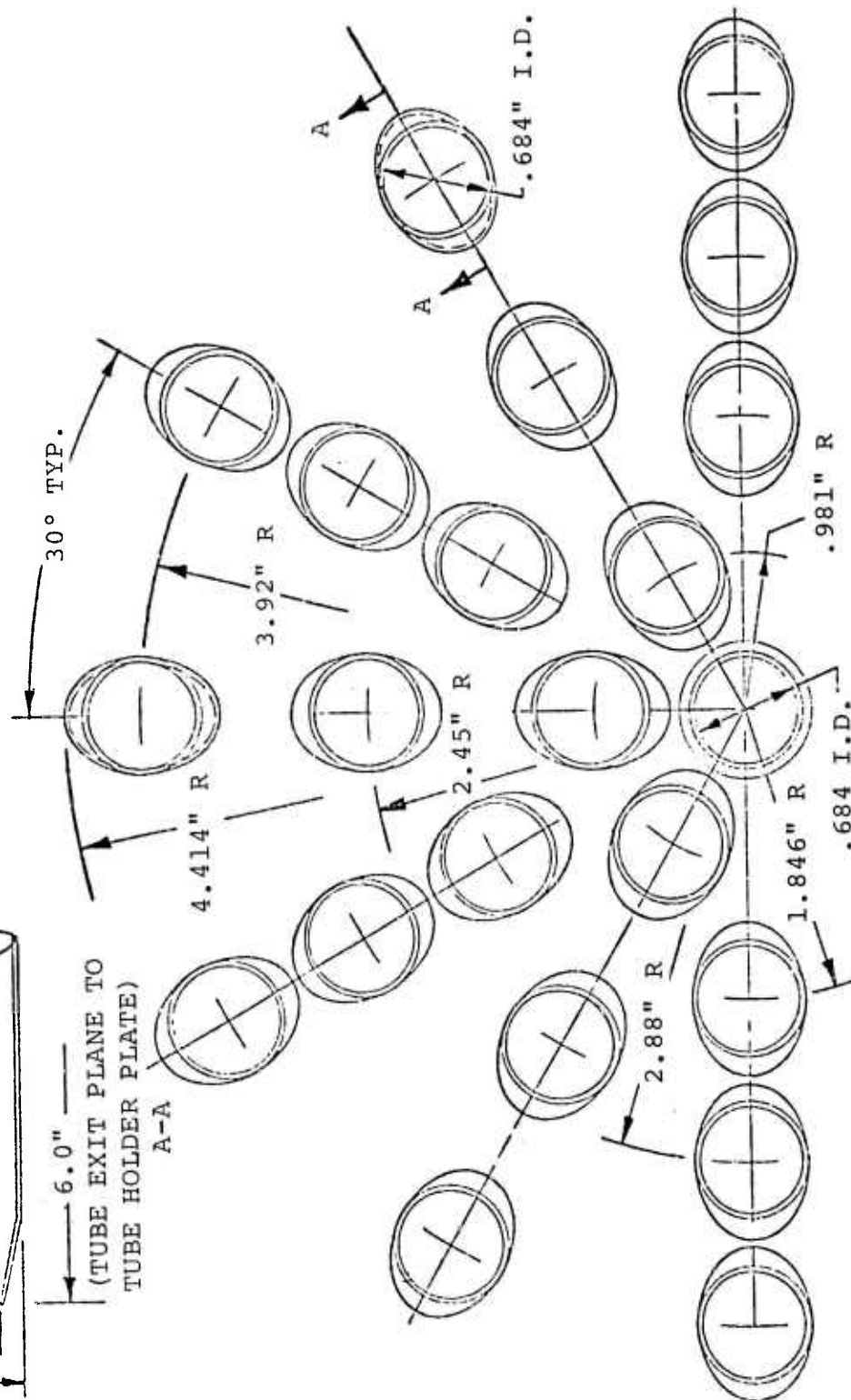
37T-4.5AR-RA-ET/RC NOZZLE

12° NOM.



MAT'L-.035" WALL,

NOTE: CENTER TUBE IS A .875" DIA TUBE
WITH A 12° NOM. CONVERGENCE TO .684"
DIA. EXIT



37 TUBE - AREA RATIO 4.5 ELLIPTICAL TUBES RADIAL ARRAY

TEST CONDITIONS

NOZZLE: 37T-4.5AR-RA-ET/RC

FACILITY: HNTF

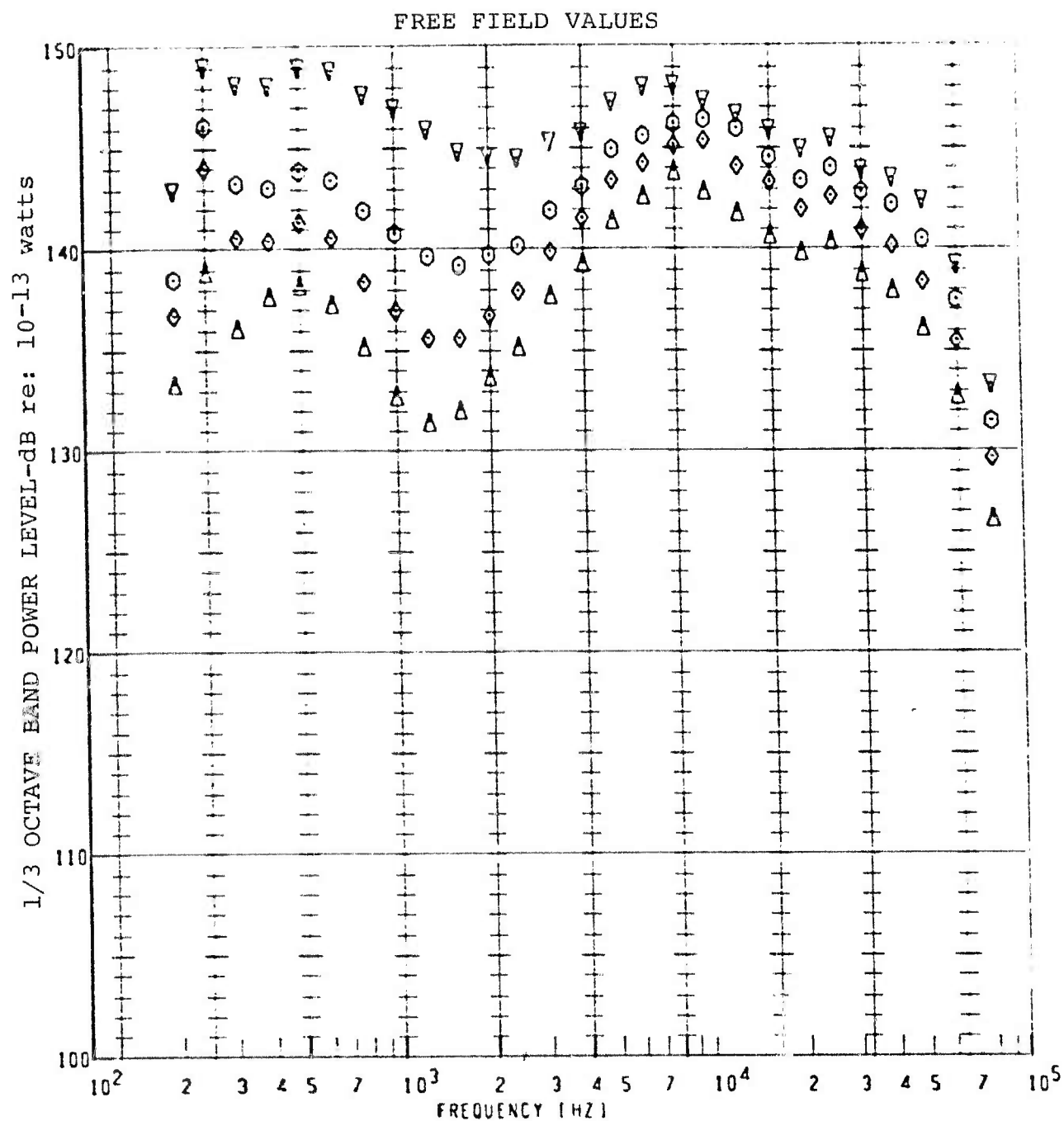
DATE: 1-26-73

T_{AMB} = 41.4°F **R.H.** = 80%

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
215	2.0	1150°F	1875 fps	3" tube lengths	
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

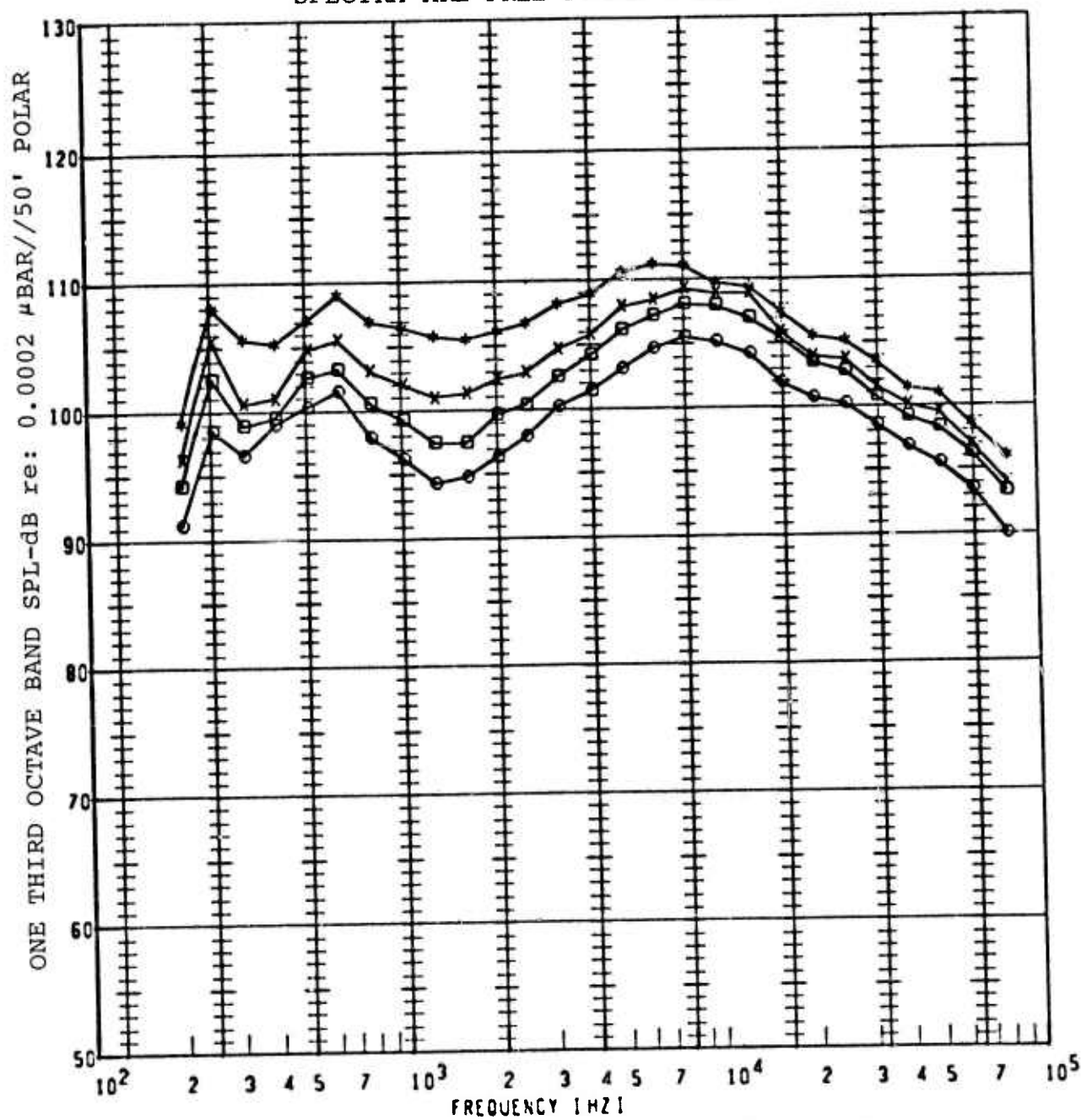


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	215	2.00	1150°F
◊	215	2.50	1150
○	215	3.00	1150
▽	215	4.00	1150

NOZZLE: 37T-4.5AR-RA-ET/RC

JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB

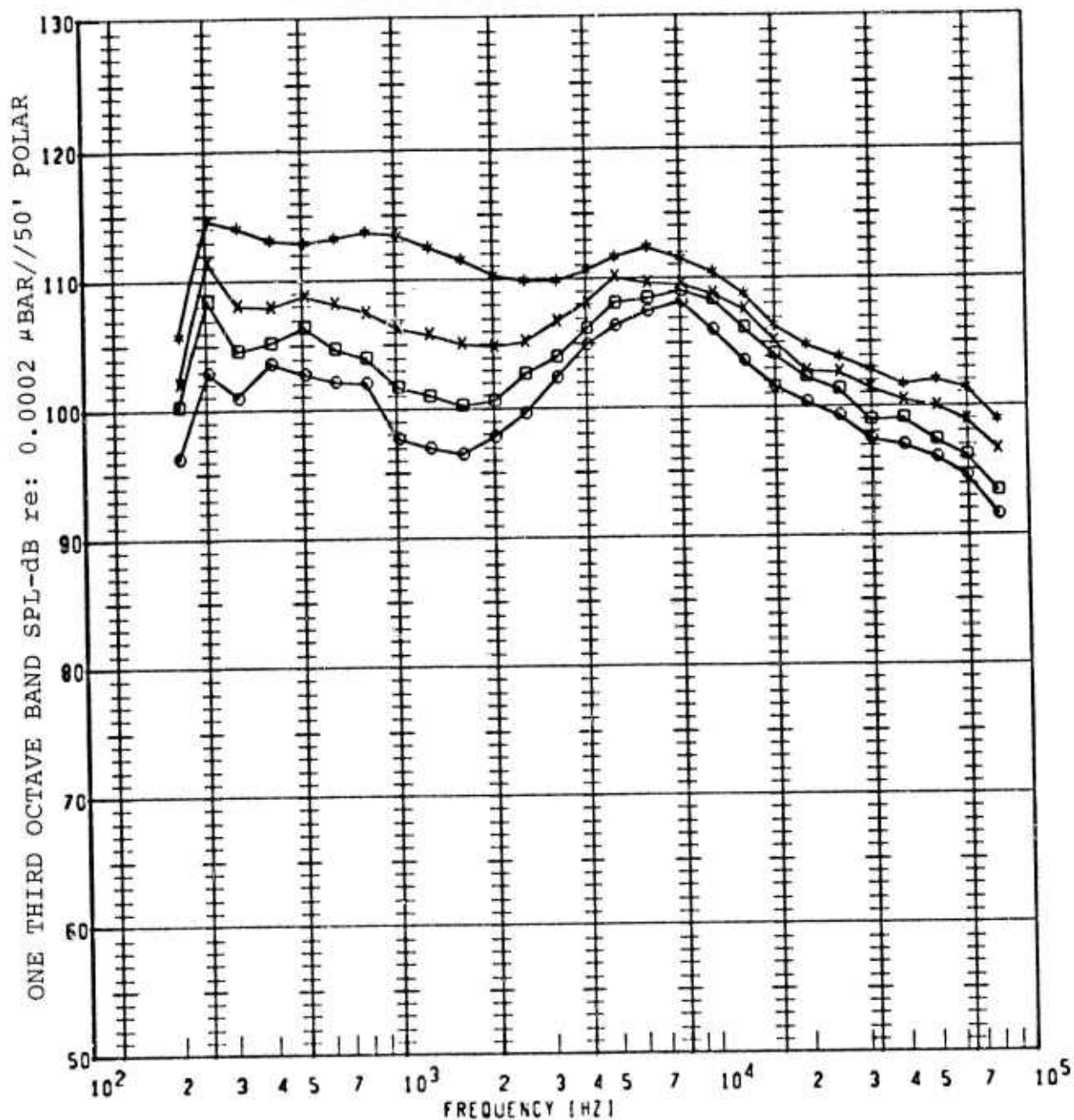


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL 1091
○	215G	1150°F	2.000	110°	SOFP	114.7
◻	215G	1150	2.500	↓	SOFP	117.4
x	215G	1150	3.000	↓	SOFP	119.0
*	215G	1150	4.000	↓	SOFP	121.5

NOZZLE: 37T-4.5AR-RA-ET/RC

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB

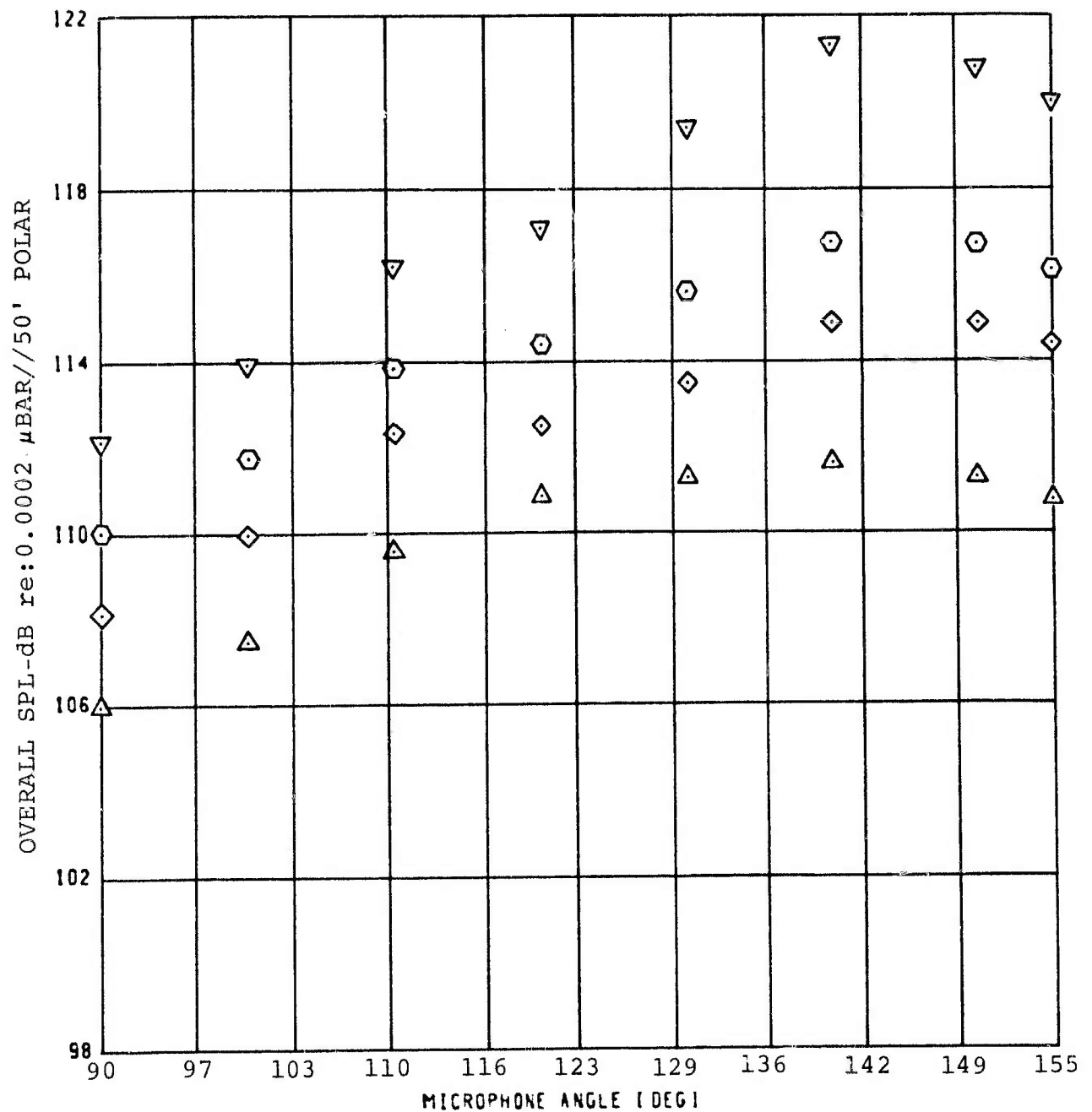


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL 10B1
○	215G	1150°F	2.000	130°	50FP	116.7
◻	215G	1150	2.500	↓	50FP	118.9
x	215G	1150	3.000	↓	50FP	121.1
*	215G	1150	4.000	↓	50FP	125.1

NOZZLE: 37T-4.5AR-RA-ET/RC

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	215	2.00	1150°F
◇	215	2.50	1150
○	215	3.00	1150
▽	215	4.00	1150

NOZZLE: 37T-4.5AR-RA-ET/RC

OASPL BEAM PATTERNS

SAE RC NOZZLE
 $A_8 = 12.6 \text{ FT}^2$

AVERAGE RC NOZZLE

37T-4.5AR-RA-ET/RC

1000' ALTITUDE

20° ENGINE ATTITUDE

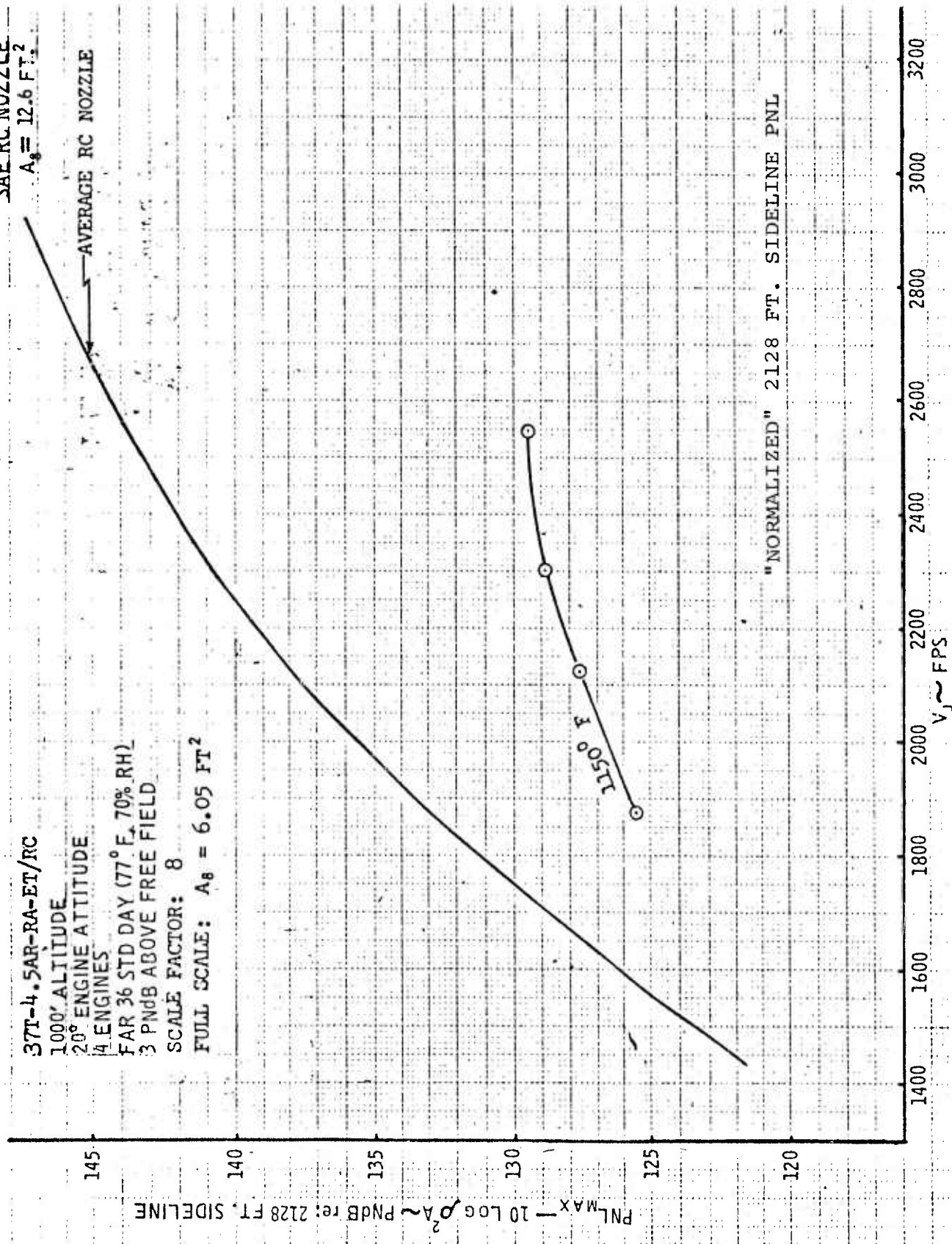
4 ENGINES

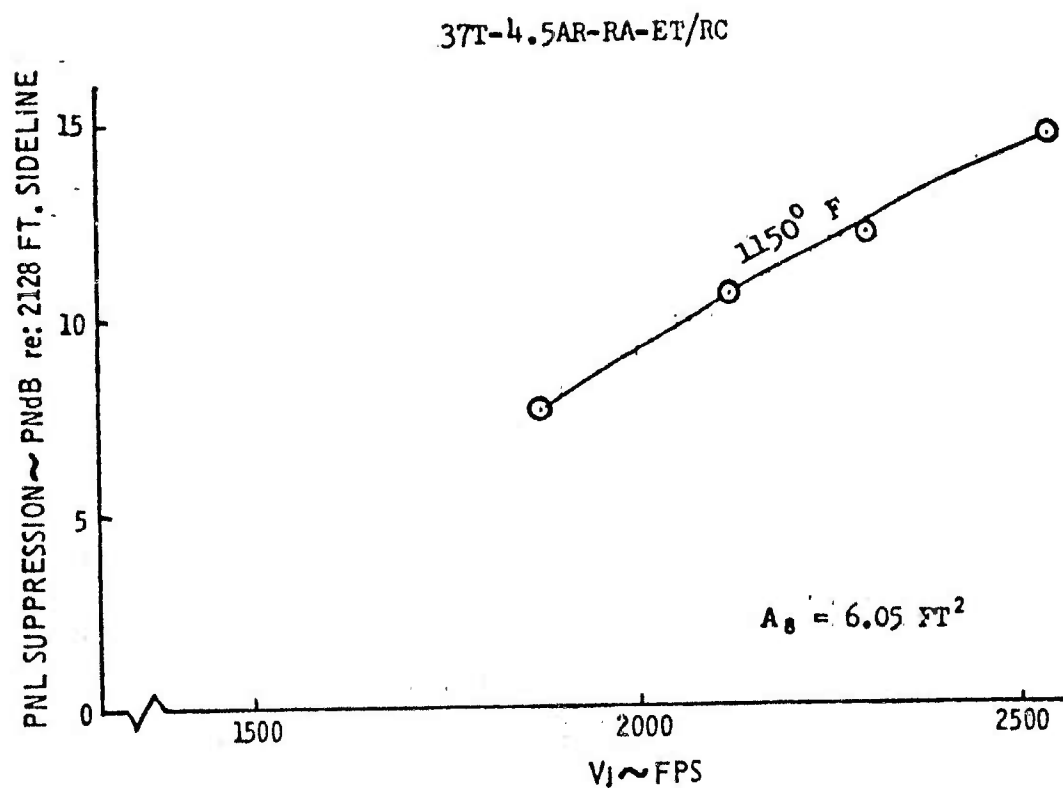
FAR 36 STD DAY (77° F, 70% RH)

3 PNdB ABOVE FREE FIELD

SCALE FACTOR: 8

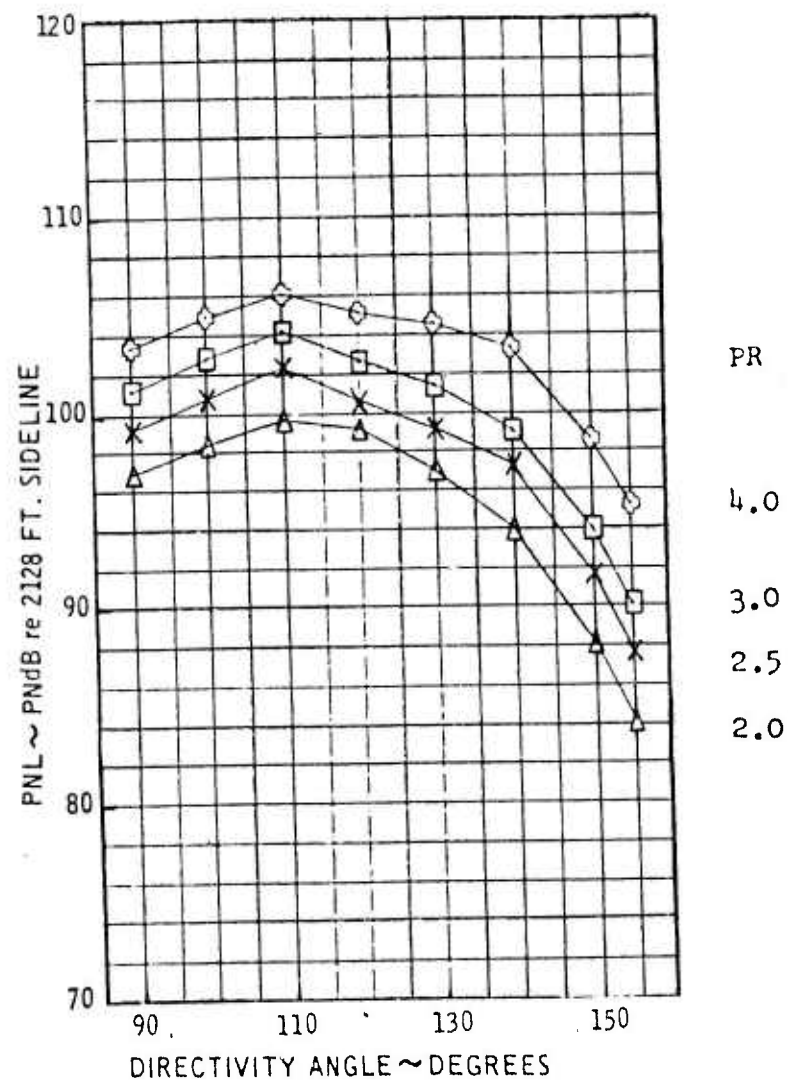
FULL SCALE: $A_8 = 6.05 \text{ FT}^2$





PEAK PNL SUPPRESSION VALUES

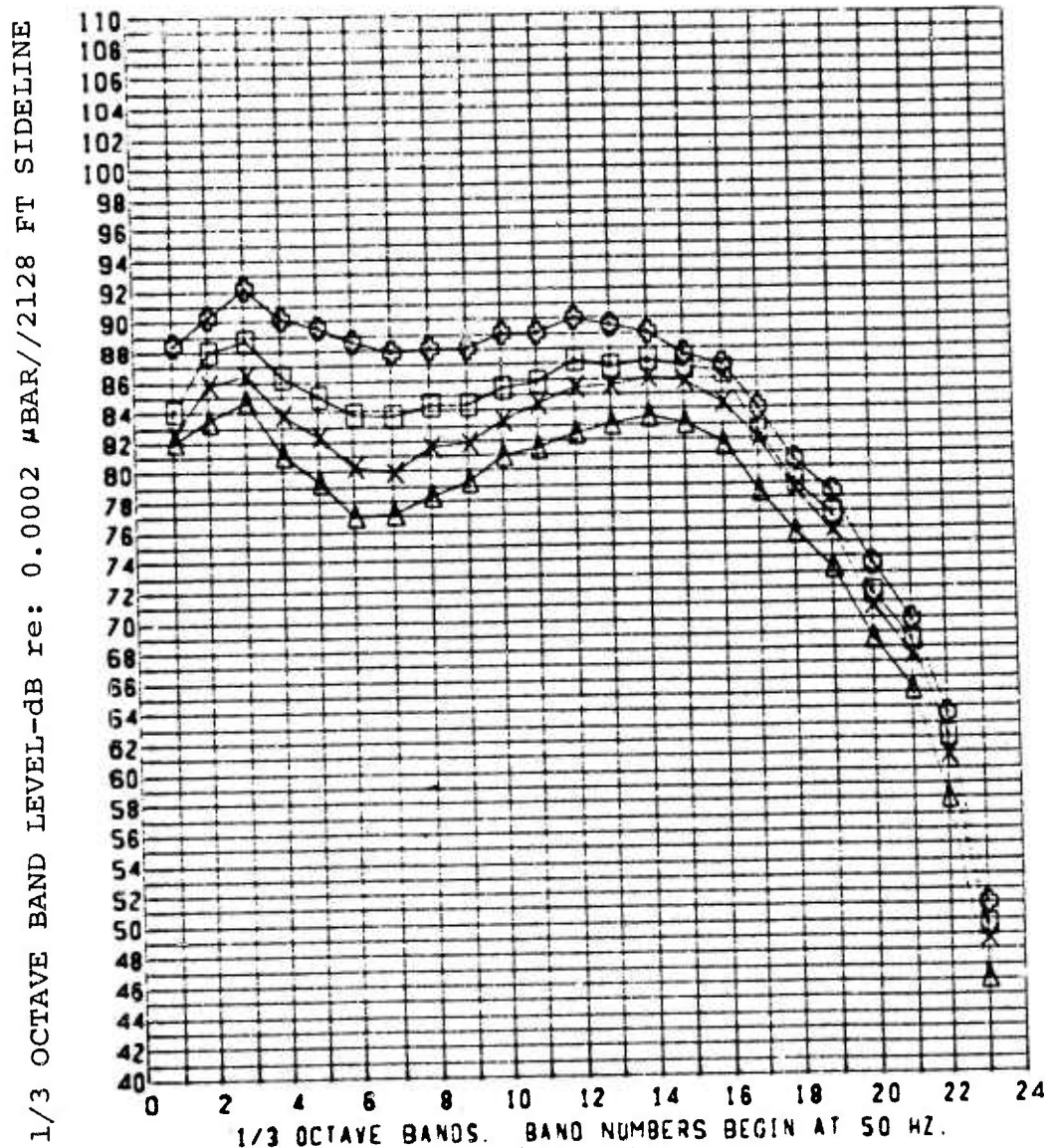
NOZZLE: 37T-4.5AR-RA-ET/RC



RUN 215
 $T_T = 1150^{\circ} F$ $A_8 = 6.05 \text{ FT}^2$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



TT = 1150°F A8 = 6.05 FT² RUN: 215
 PR = Δ 2.0, X 2.5, □ 3.0, + 4.0,

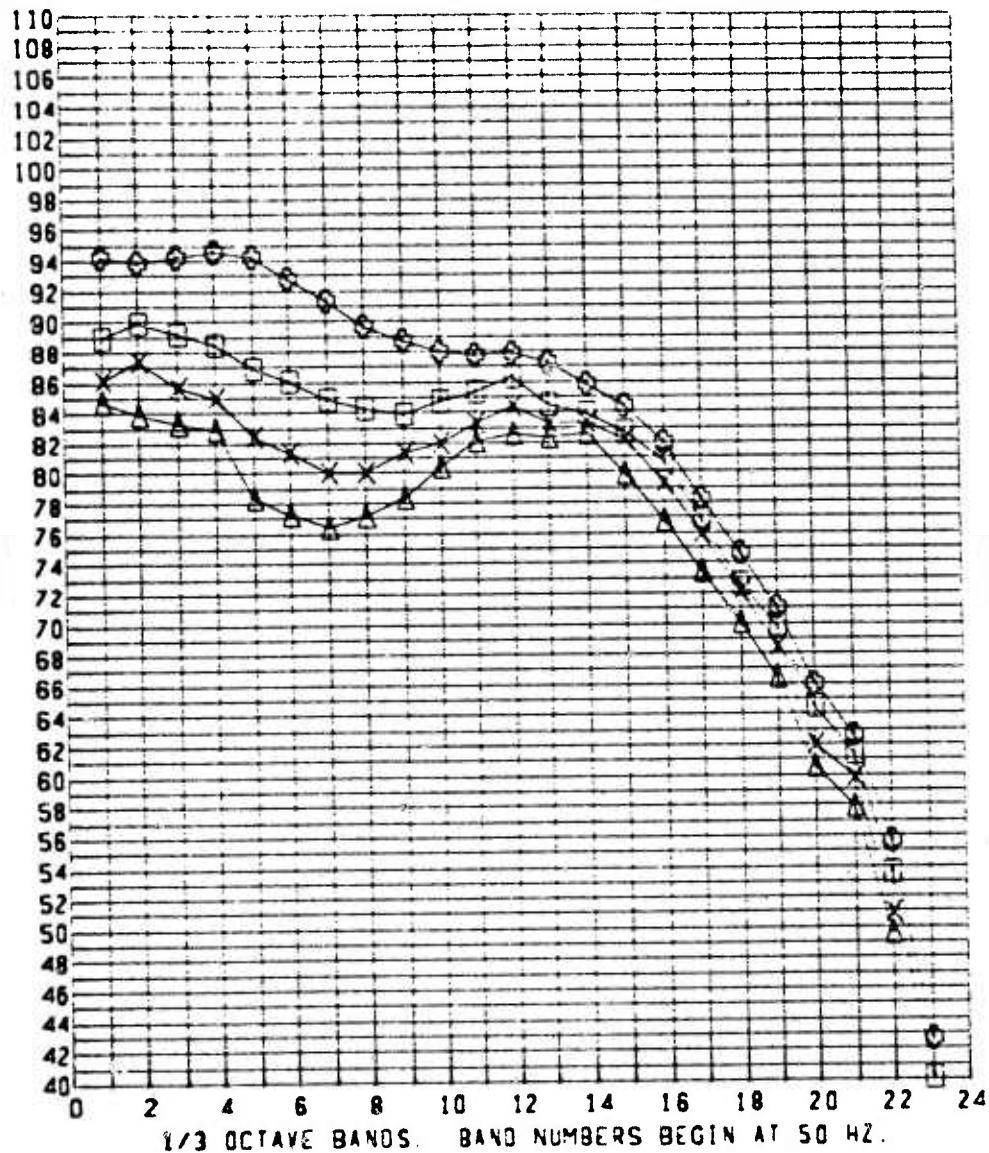
NOZZLE: 37T-4.5AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110° re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μBAR//2128 FT SIDELINE



Tt = 1150°F A8 = 6.05 FT² RUN: 215
 PR = Δ 2.0, X 2.5, □ 3.0, + 4.0

NOZZLE: 37T-4.5AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
 re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 37T-4.5AR-RA-ET/RC

FACILITY: WALL ISOLATION FACILITY

DATE: January 21, 1973

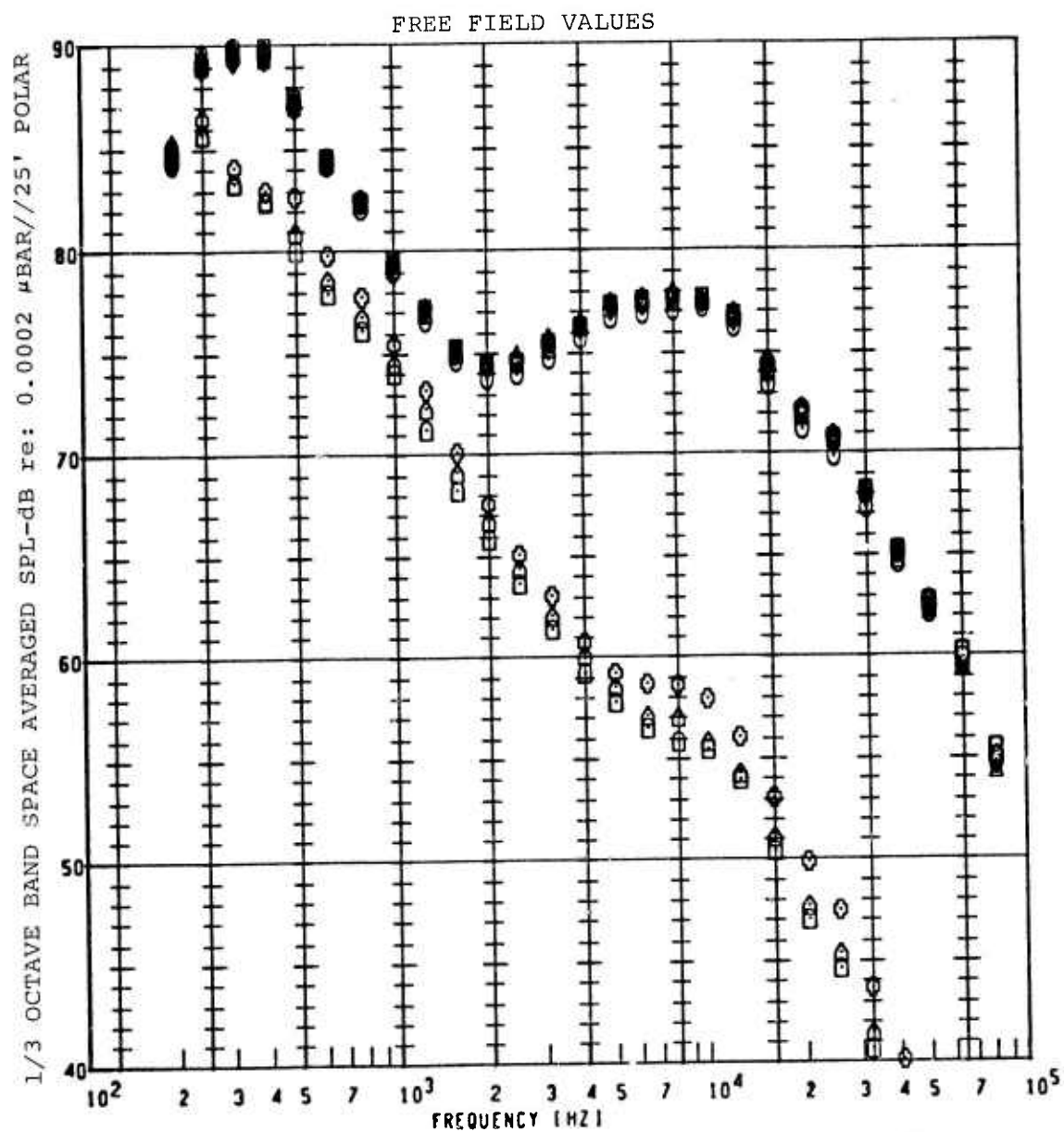
P_AM_B = 30.06 in Hg **T_AM_B** = 41°F **R.H.** = 85%

NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

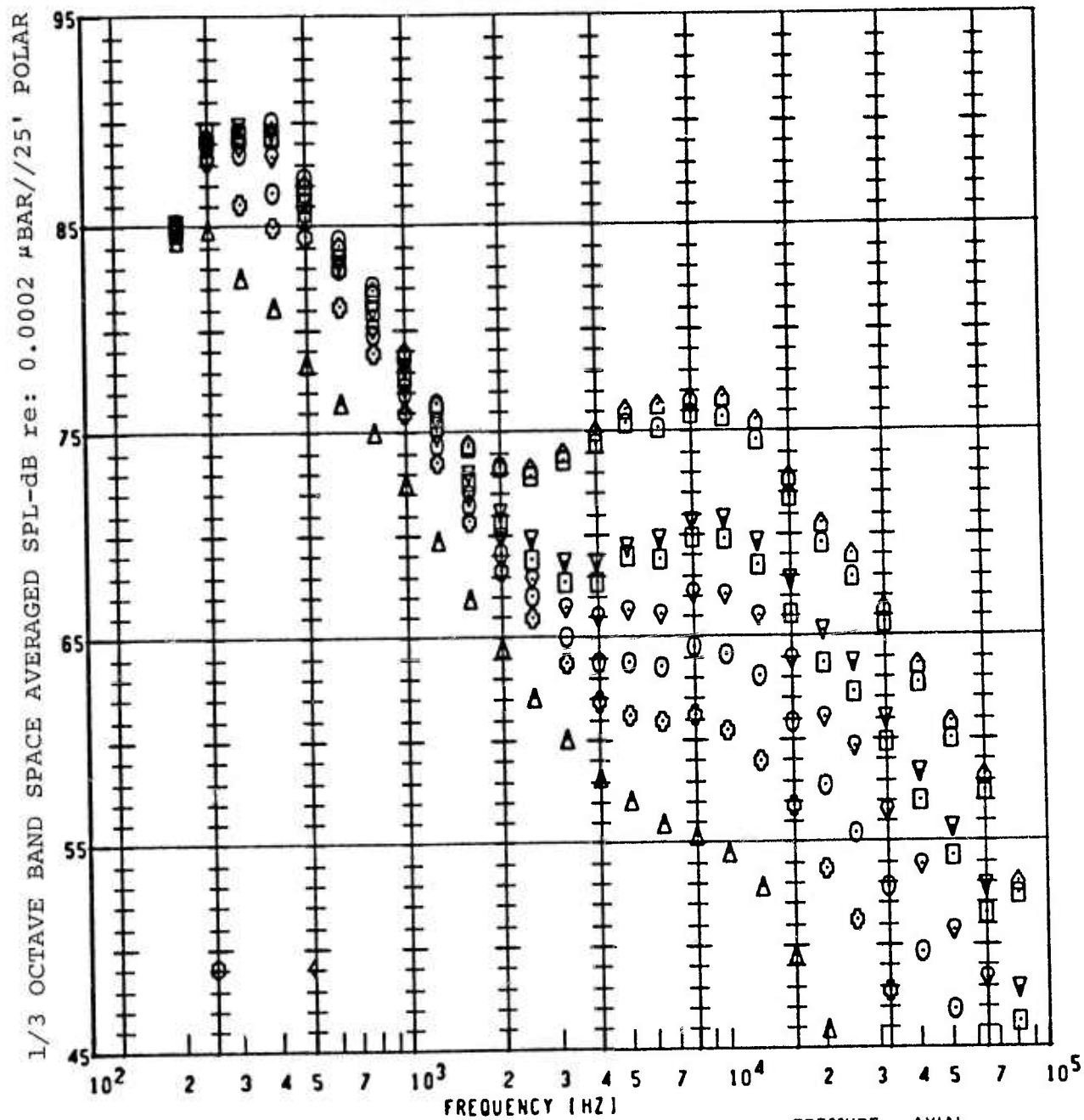
<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
168	0.0 x/D	11.0 in.		
169	0.25	11.0		
170	0.50	11.5		
171	0.75	11.5		
172	1.00	12.0		
173	1.25	12.0		
174	1.50	12.0		
175	1.75	12.5		
176	2.00	12.5		
177	2.25	13.0		
178	2.50	13.0		
179	2.75	13.5		
180	3.0	13.5		
181	3.5	14.0		
182	4.0	14.5		
183	5.0	15.5		
184	6.0	16.5		
185	8.0	18.0		
186	10.0	20.0		
187	12.0	22.0		
188	14.0	24.0		
189	16.0	25.5		

MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC



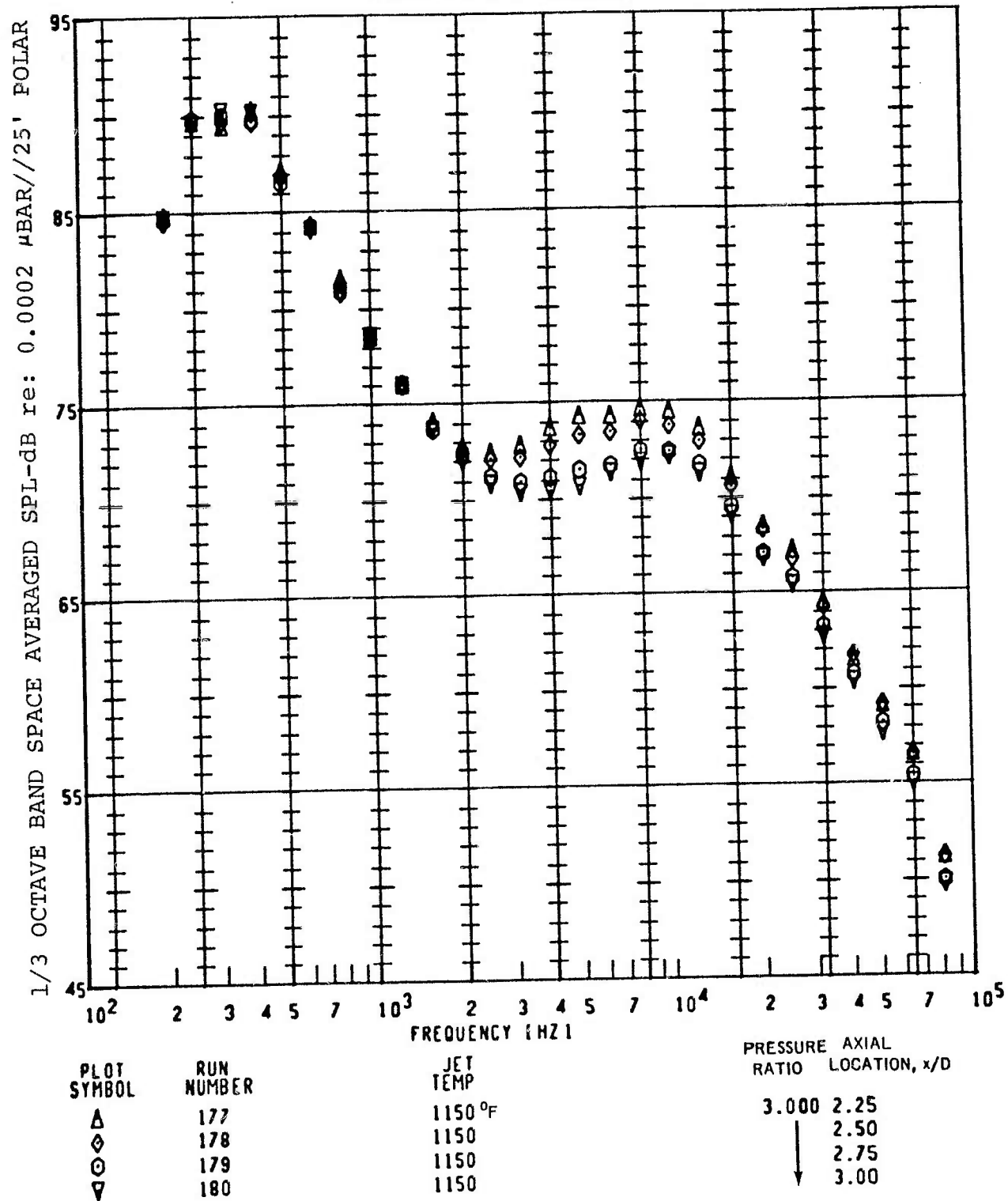
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
Δ	168	1150°F	3.000	0.00
\diamond	169	1150		0.25
\circ	170	1150		0.50
∇	171	1150		0.75
\square	172	1150		1.00
\circ	173	1150		1.25
\circ	174	1150		1.50
\circ	186	1150		10.00
\triangle	187	1150		12.00
\square	188	1150		14.00

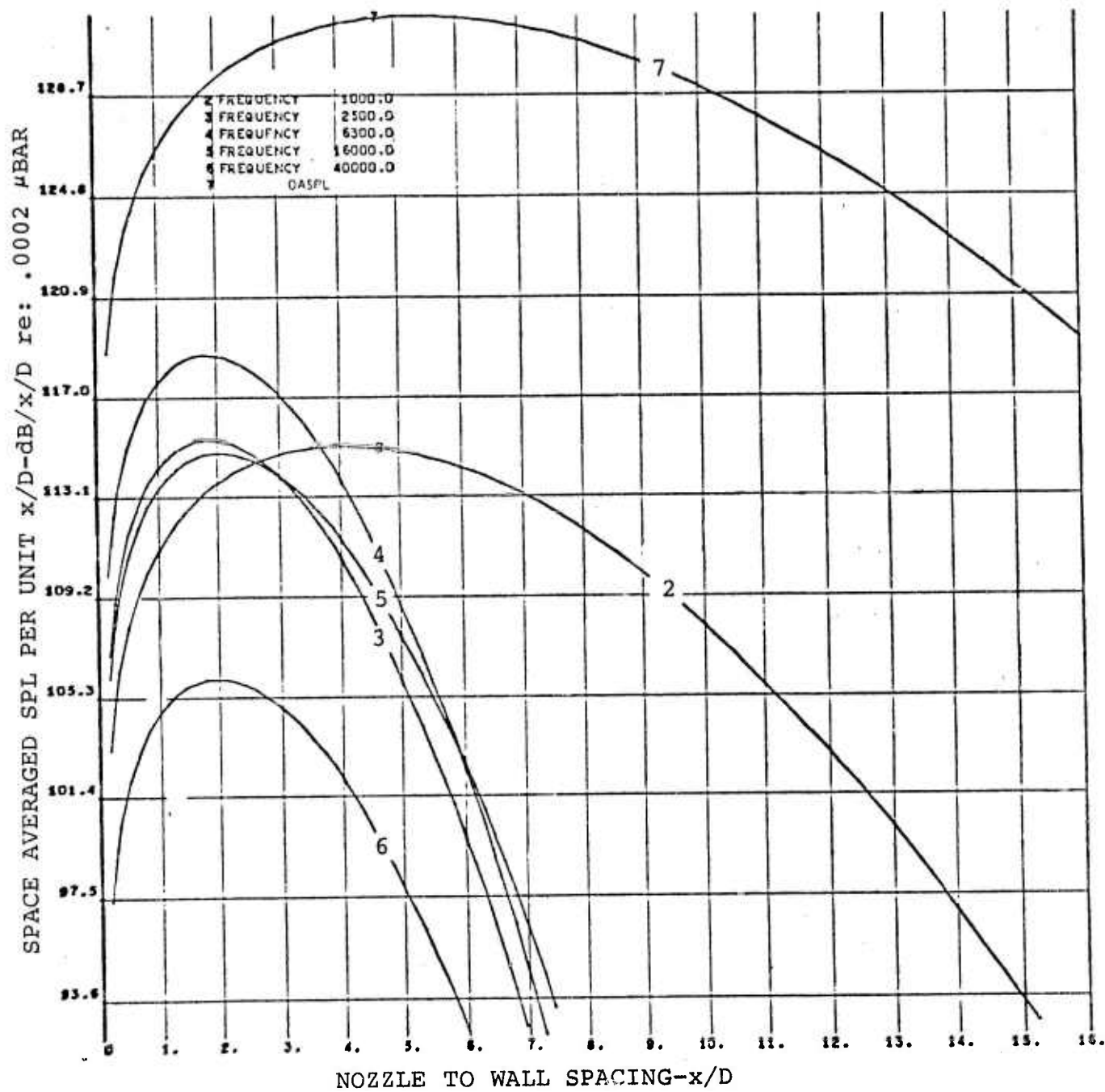
FREE FIELD VALUES

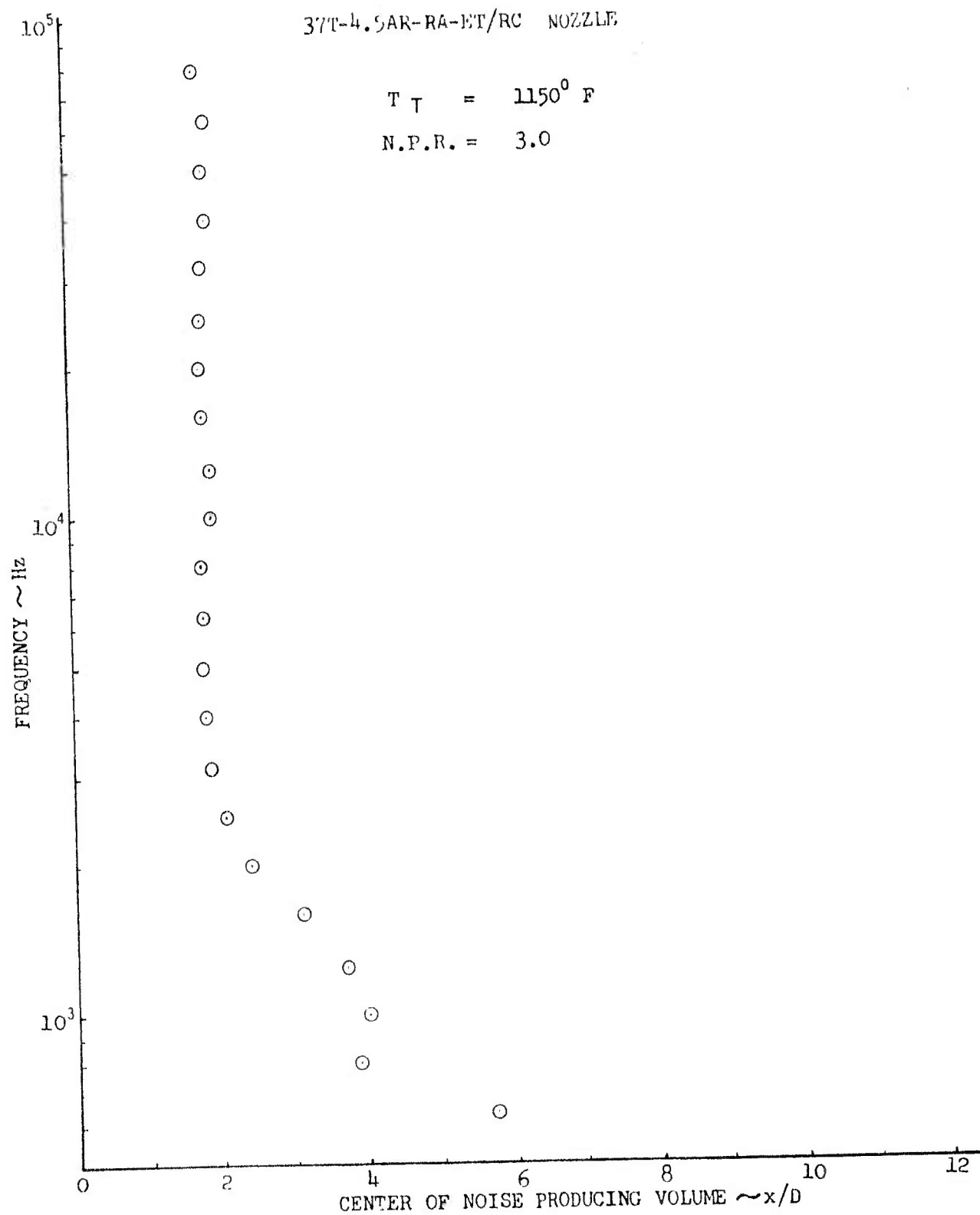


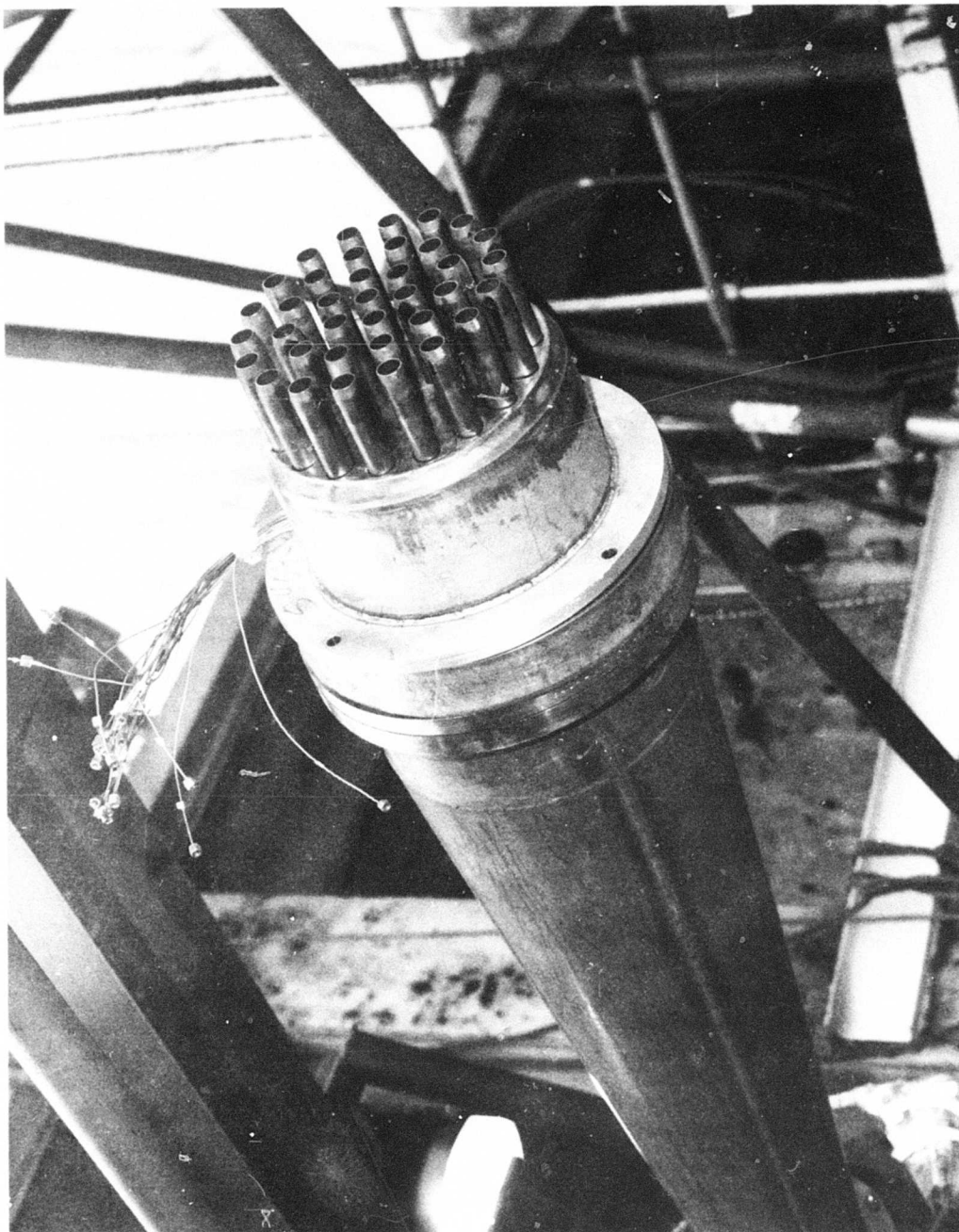
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	AXIAL LOCATION, x/D
△	189	1150°F	3.0	16.00
▽	181	1150	3.0	3.50
□	182	1150	3.0	4.00
◇	183	1150	3.0	5.00
○	184	1150	3.0	6.00
⊙	185	1150	3.0	8.00
⊠	175	1150	3.0	1.75
◻	176	1150	3.0	2.00

FREE FIELD VALUES

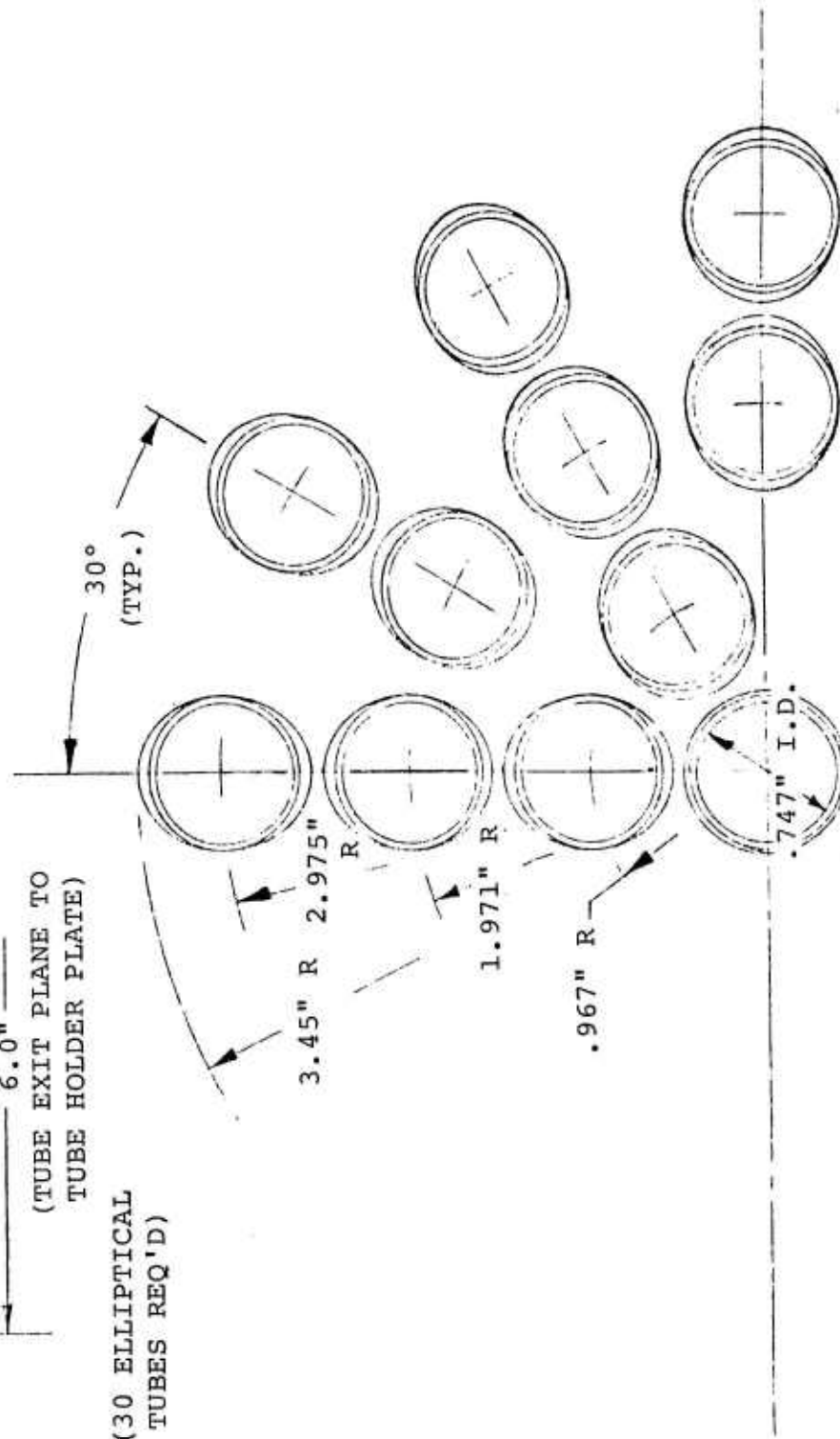
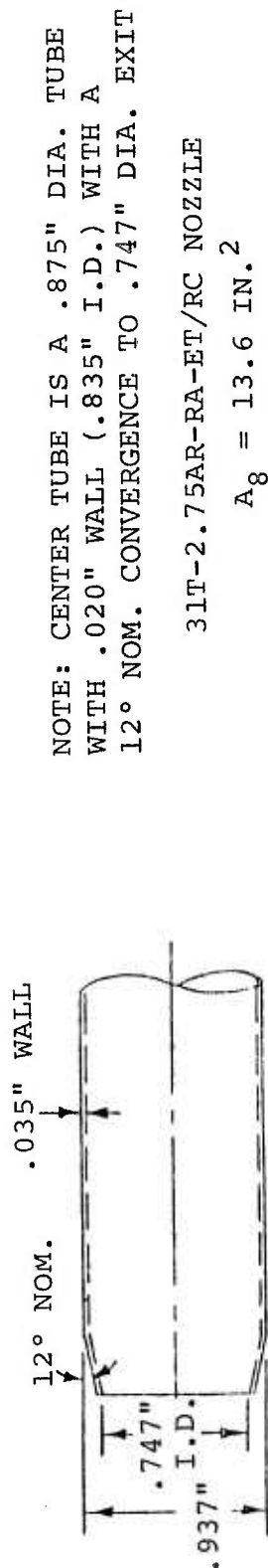








31T-2.75AR-RA-ET/RC NOZZLE



31 TUBE - AREA RATIO 2.75 ELLIPTICAL TUBES RADIAL ARRAY

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC

FACILITY: HNTF

DATE: 6-18-73

T_{AMB} = 58°F

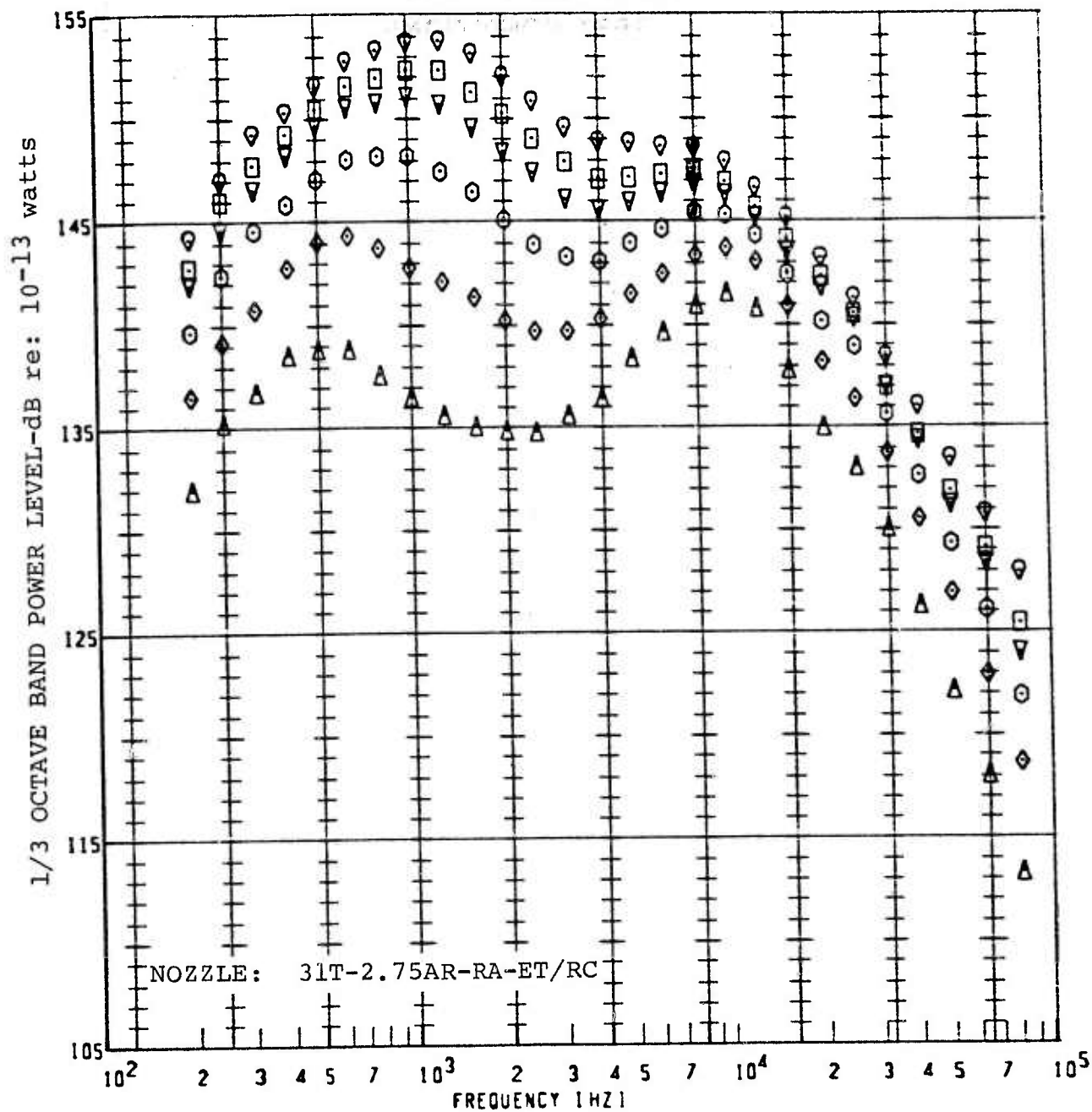
R.H. = 66%

SCALE MODEL $A_8 = 13.6 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
82	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

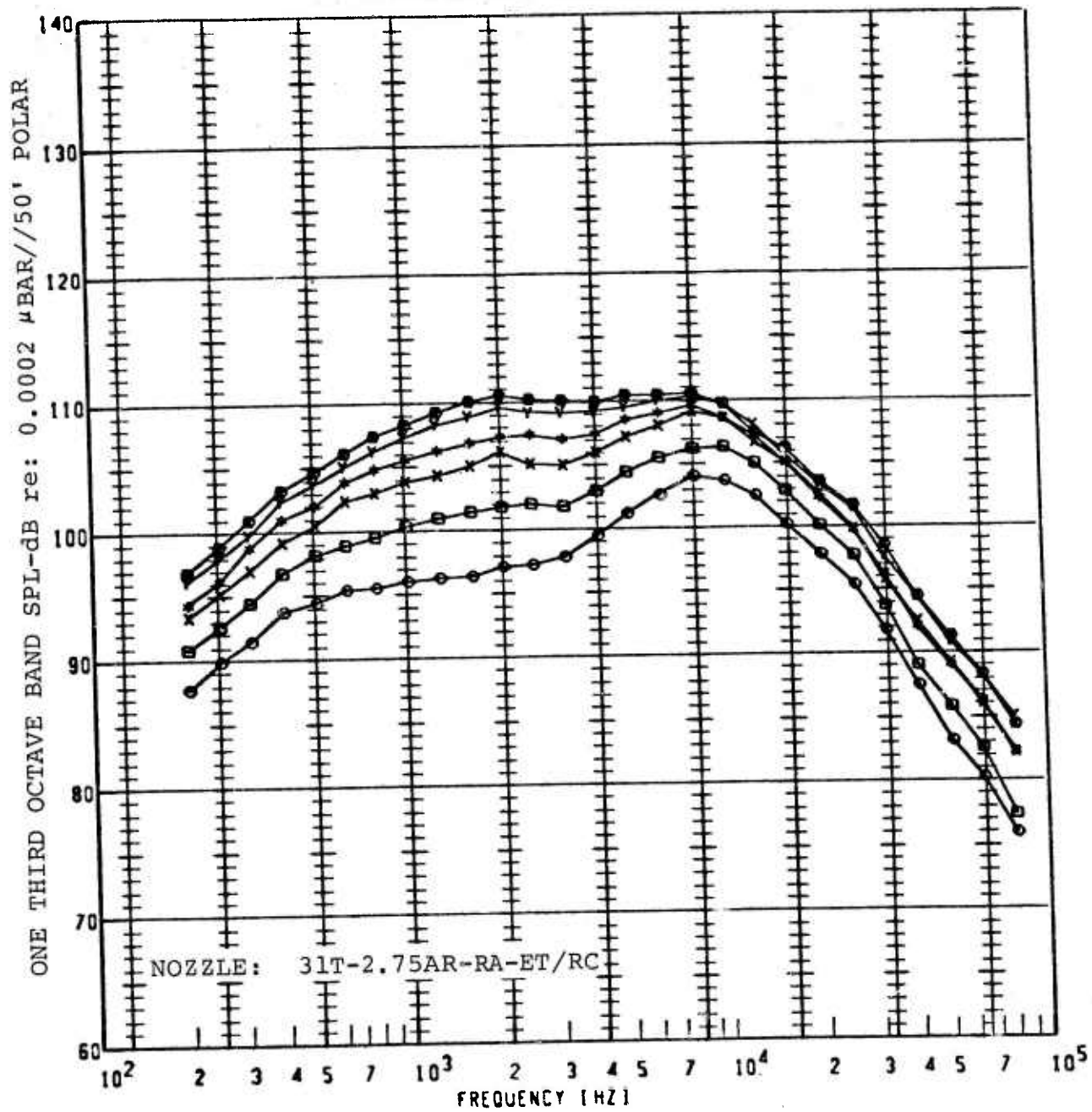
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	82	2.00	1150°F
◊	82	2.50	1150
○	82	3.00	1150
▽	82	3.40	1150
◻	82	3.70	1150
◐	82	4.00	1150

JET NOISE POWER SPECTRA

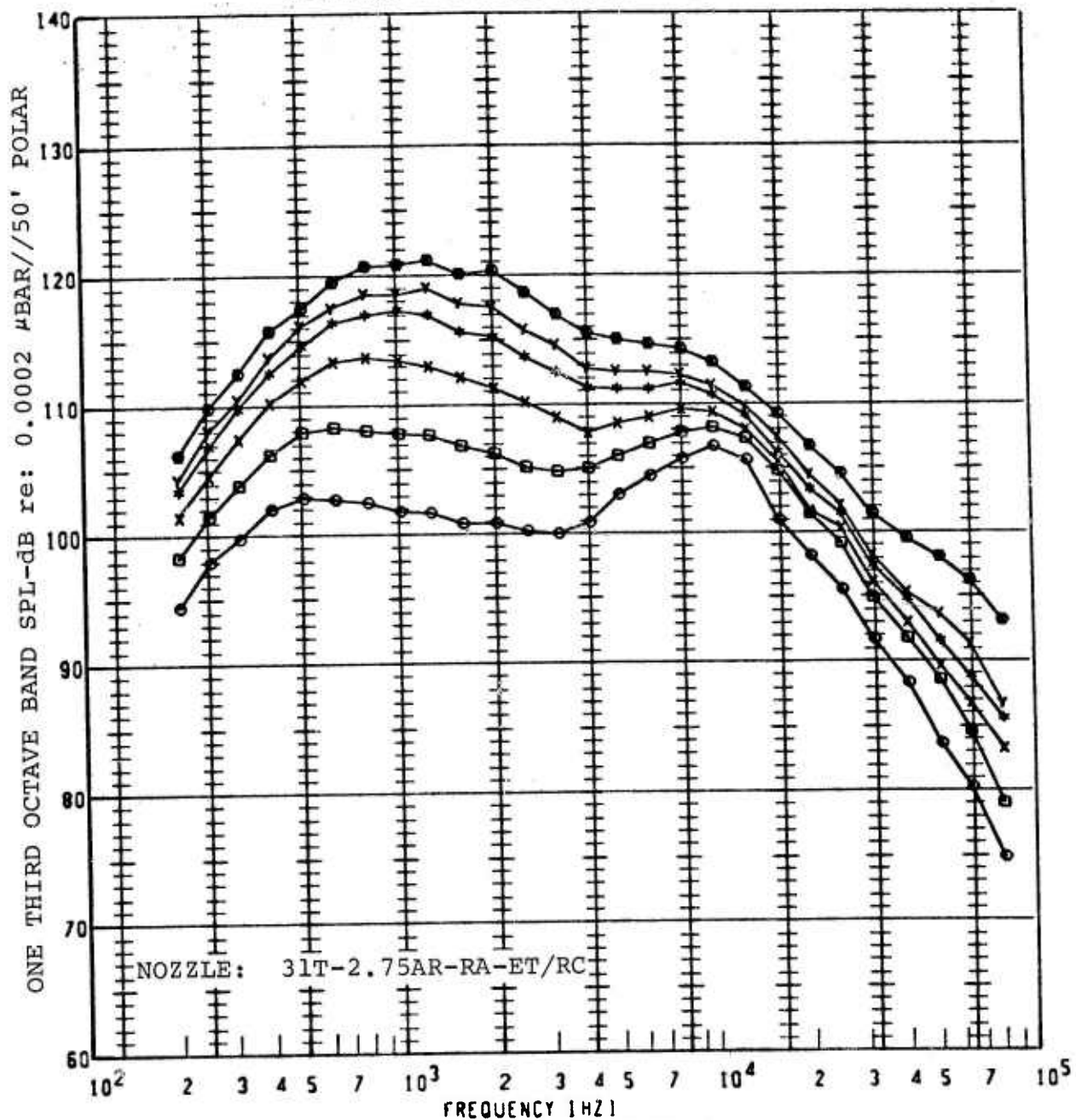
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	QASPL (DB)
●	82G	1150°F	2.000	110°	50FP	112.4
■	82G	1150	2.500	↓	50FP	115.5
x	82G	1150	3.000	↓	50FP	118.3
*	82G	1150	3.400	↓	50FP	119.4
γ	82G	1150	3.700	↓	50FP	120.8
●	82G	1150	4.000	↓	50FP	121.6

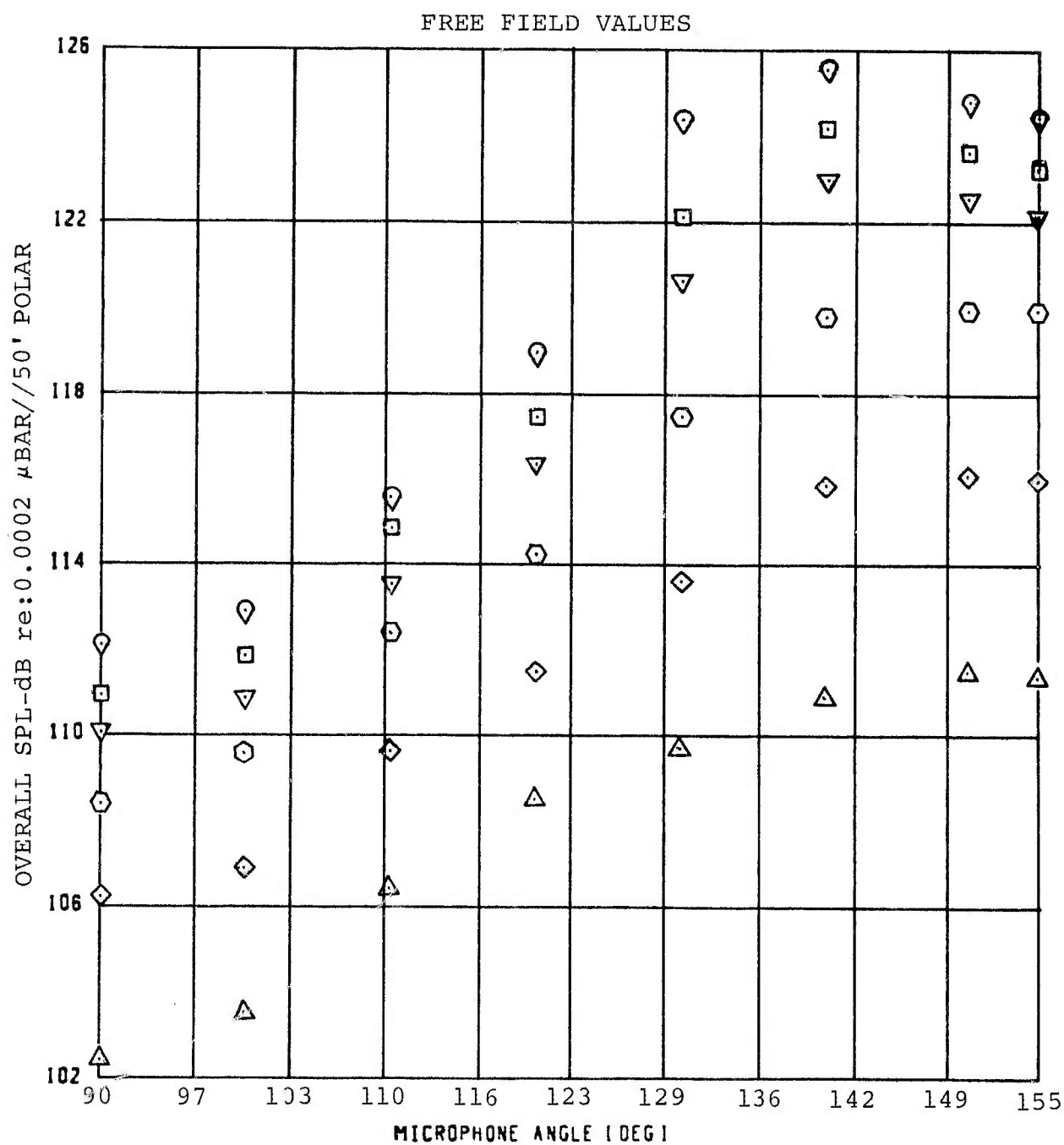
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB



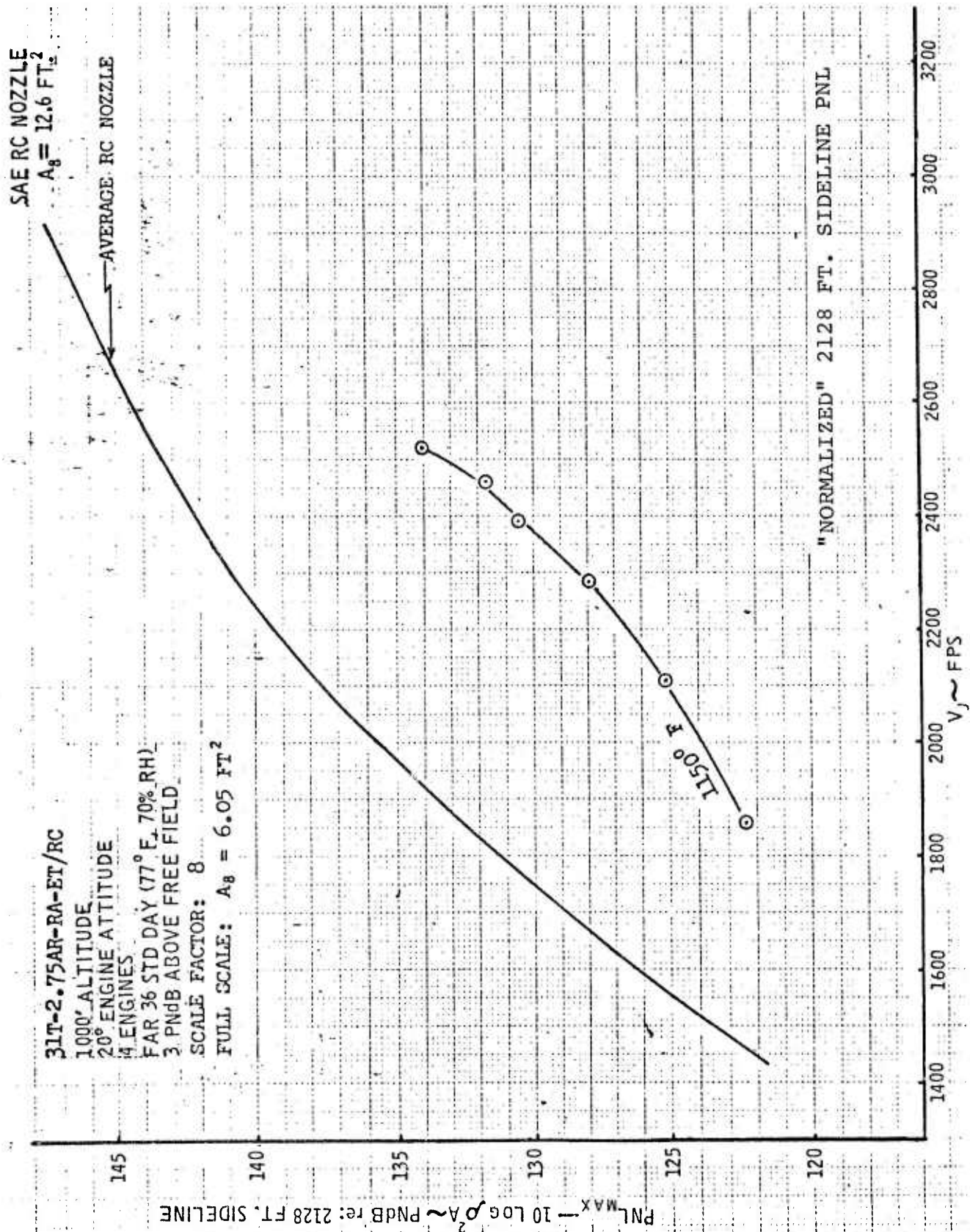
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	ASPL (dB)
○	82G	1150°F	2.000	130°	50FP	115.7
●	82G	1150	2.500	↓	50FP	119.6
x	82G	1150	3.000	↓	50FP	123.5
+	82G	1150	3.400	↓	50FP	126.6
y	82G	1150	3.700	↓	50FP	128.1
●	82G	1150	4.000	↓	50FP	130.4

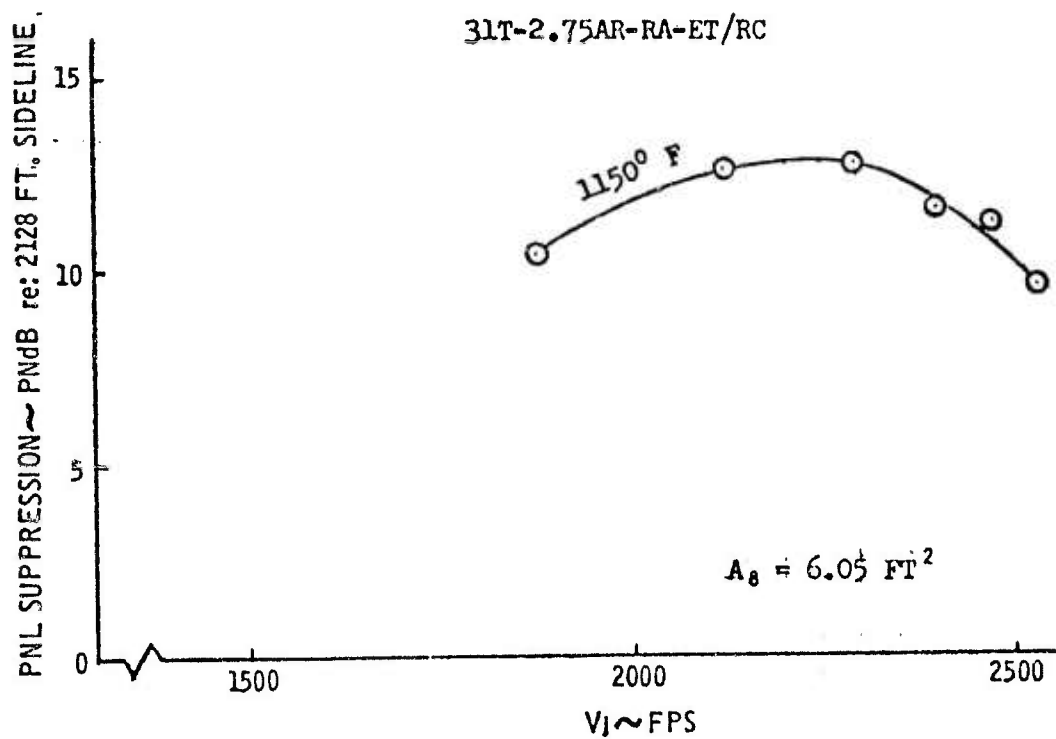
MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS



NOZZLE: 31T-2.75AR-RA-ET/RC

OASPL BEAM PATTERNS



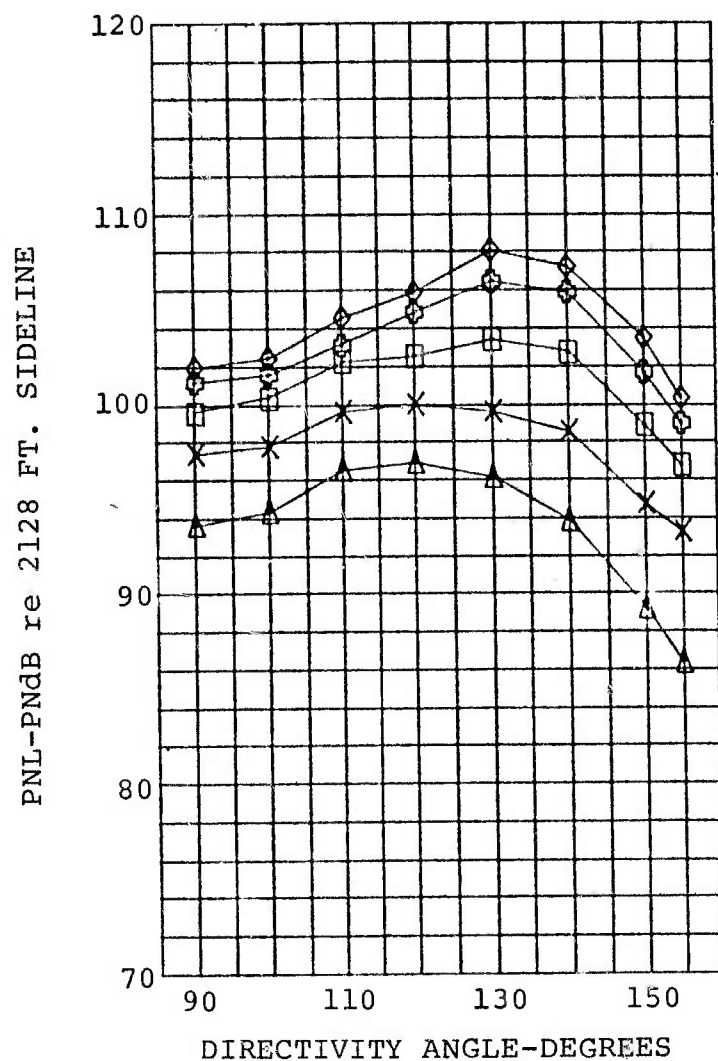


PEAK PNL SUPPRESSION VALUES

NOZZLE: 31T-2.75AR-RA-ET/RC

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = TEMP = 77 DEG R.H. = 70 PER CENT

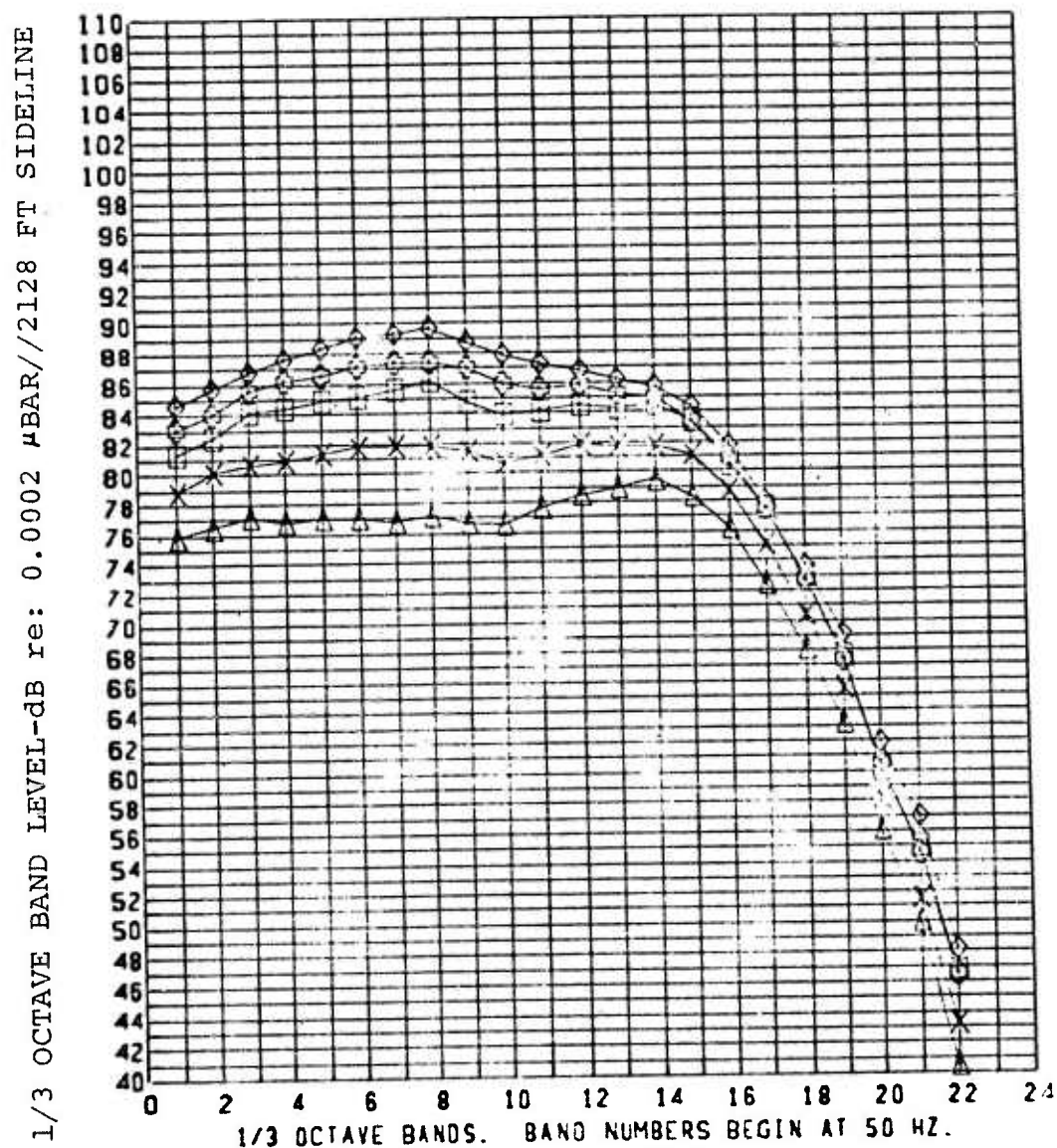


$T_t = 1150^{\circ}\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 82

PR = $\triangle 2.0$, $\times 2.5$, $\square 3.0$, $+ 3.4$, $\diamond 3.7$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



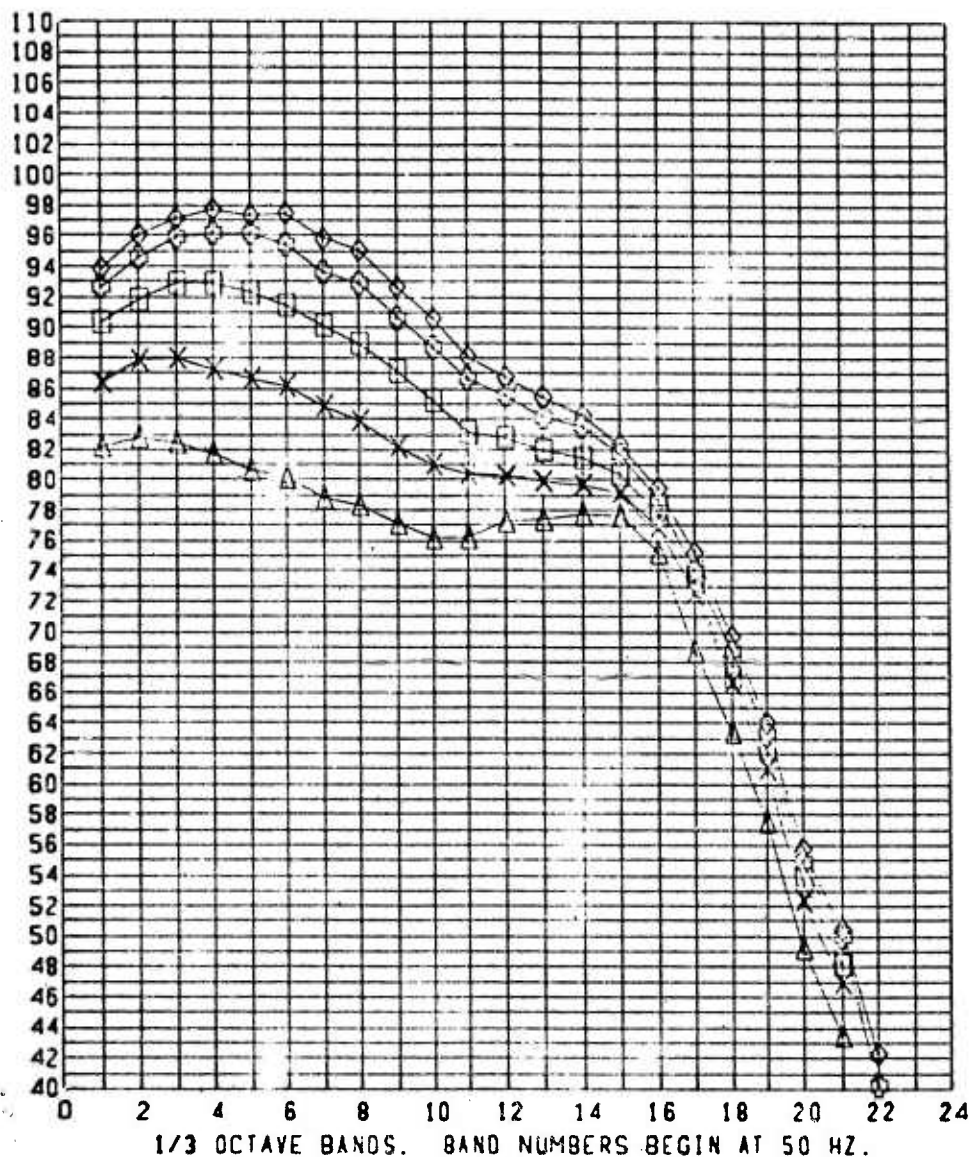
$T_t = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 82
 PR = Δ 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7

NOZZLE: 31T-2.75AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



TT = 1150°F A8 = 6.05 FT² RUN: 82
 PR = △ 2.0, × 2.5, □ 3.0, + 3.4, ◇ 3.7

NOZZLE: 31T-2.75AR-RA-ET/RC

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
 re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC
with 2.6AR Ejector

FACILITY: HNTF

DATE: 9-12-73

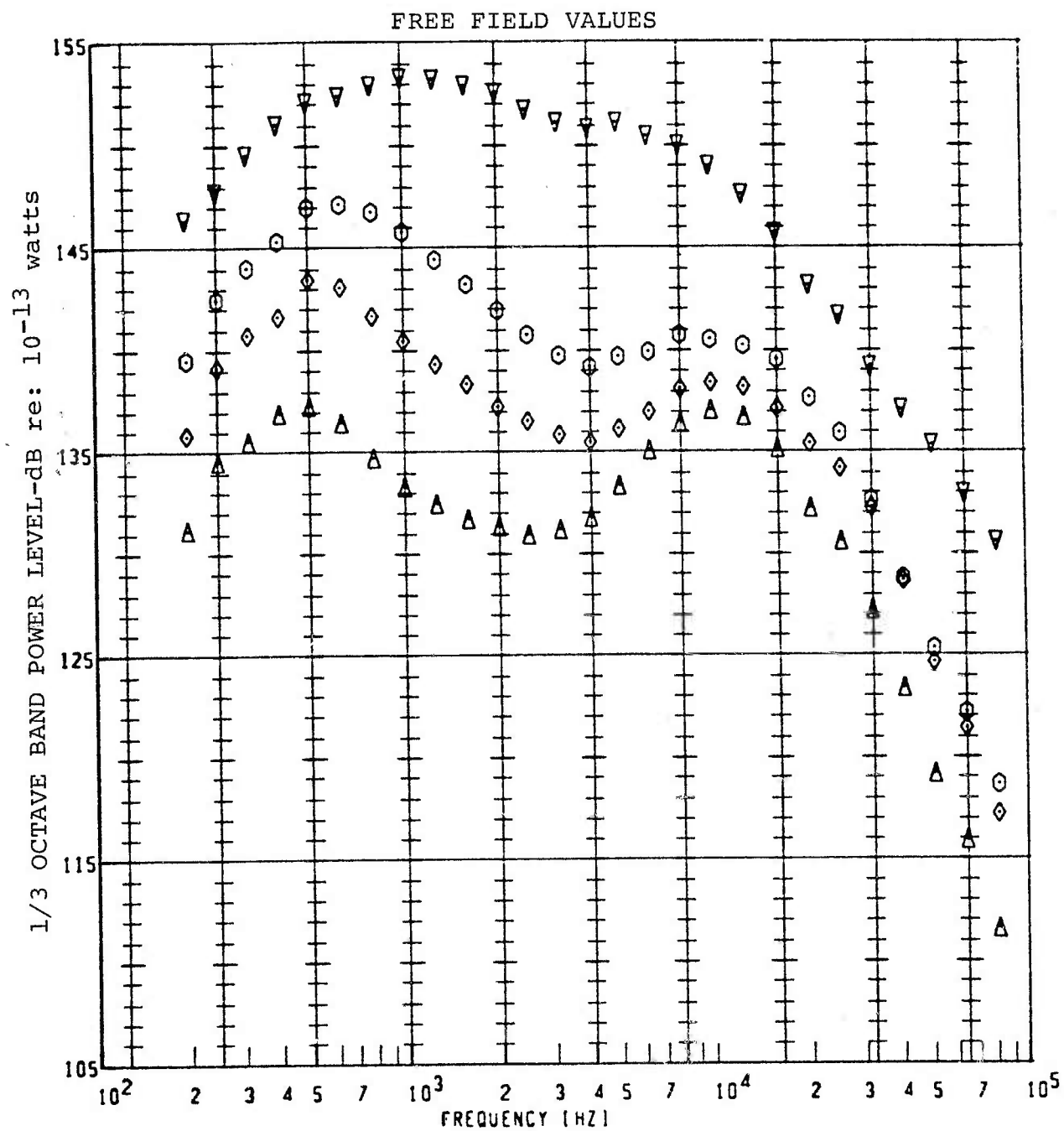
T_{AMB} = 66°F

R.H. = 72%

SCALE MODEL $A_8 = 13.6 \text{ in.}^2$

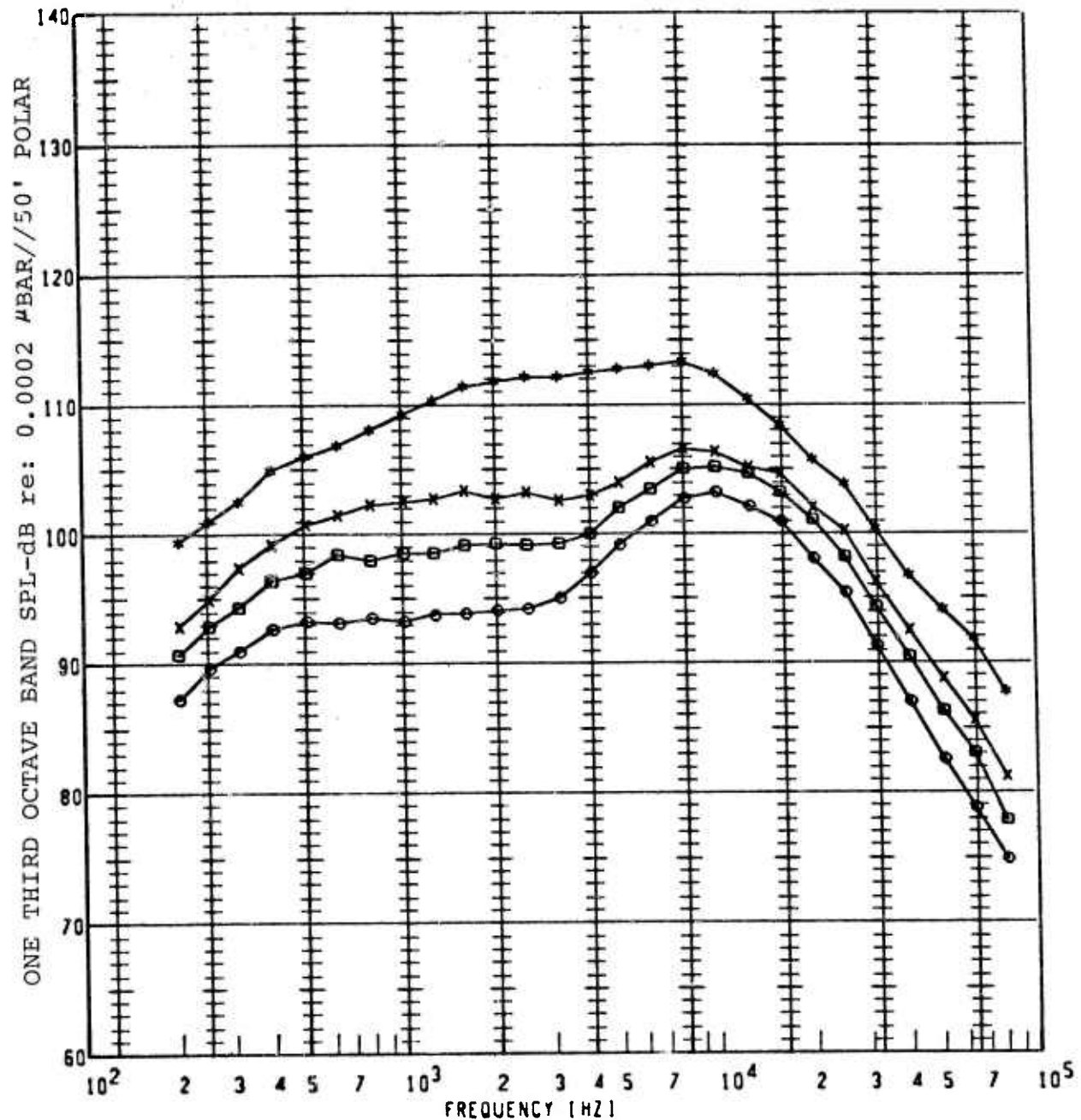
<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
65	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



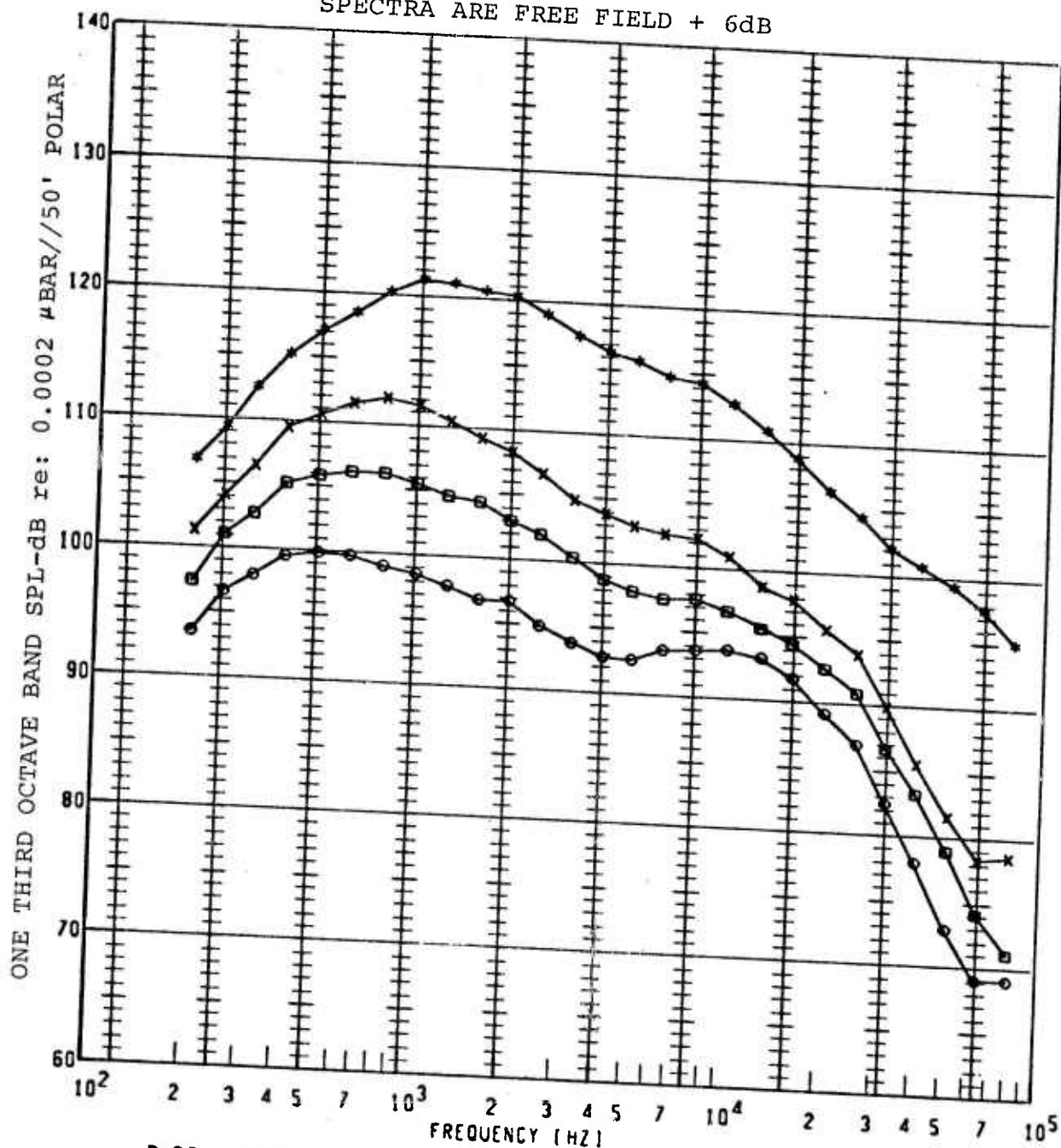
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	65	2.00	1150°F
◆	65	2.50	1150
○	65	3.00	1150
▼	65	4.00	1150

SPECTRA ARE FREE FIELD + 6dB



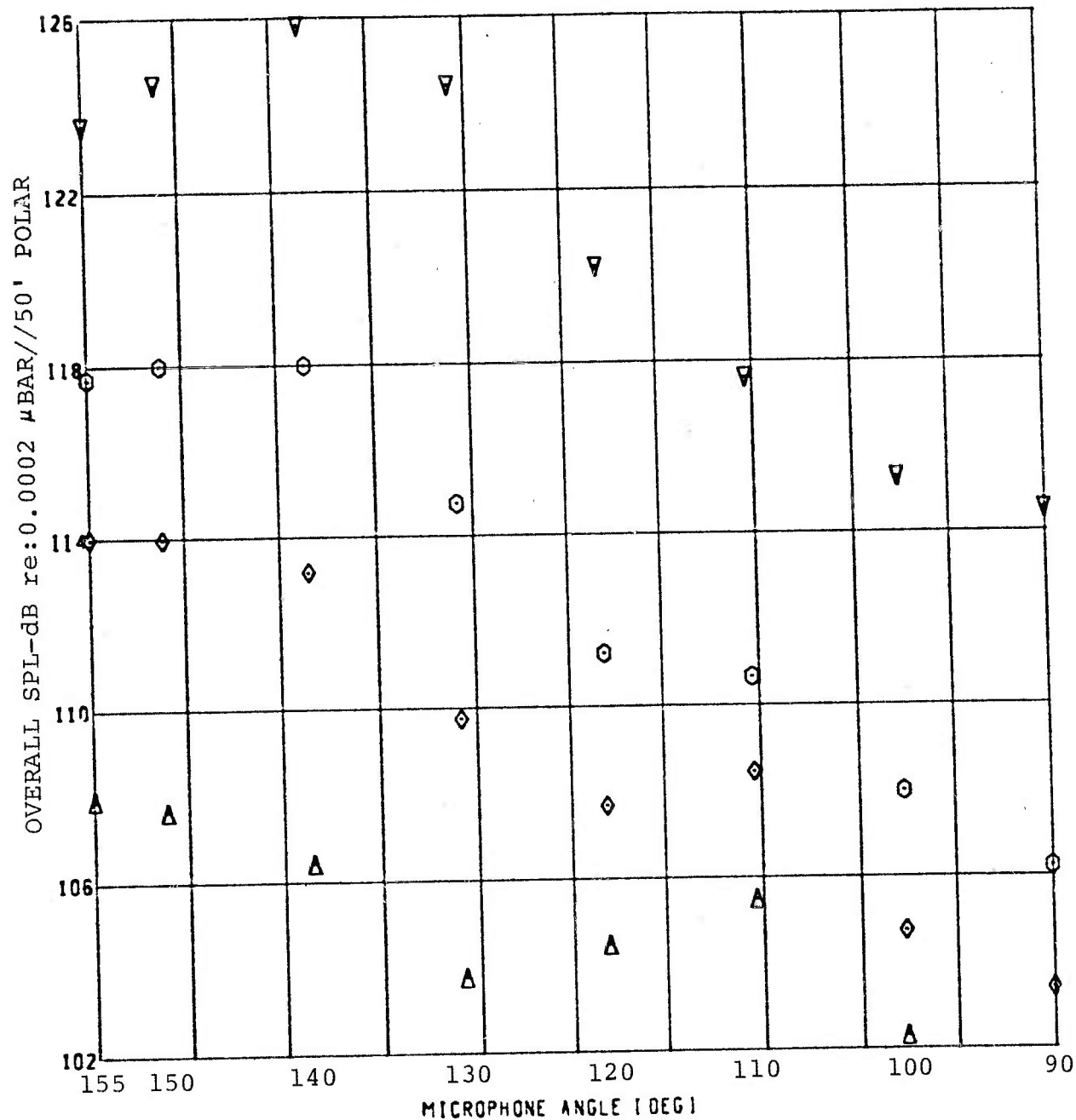
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	QASPL [dB]
○	65G	1150°F	2.000	110°	50FP	111.2
□	65G	1150	2.500	↓	50FP	114.2
x	65G	1150	3.000	↓	50FP	116.5
*	65G	1150	4.000	↓	50FP	123.5

SPECTRA ARE FREE FIELD + 6dB

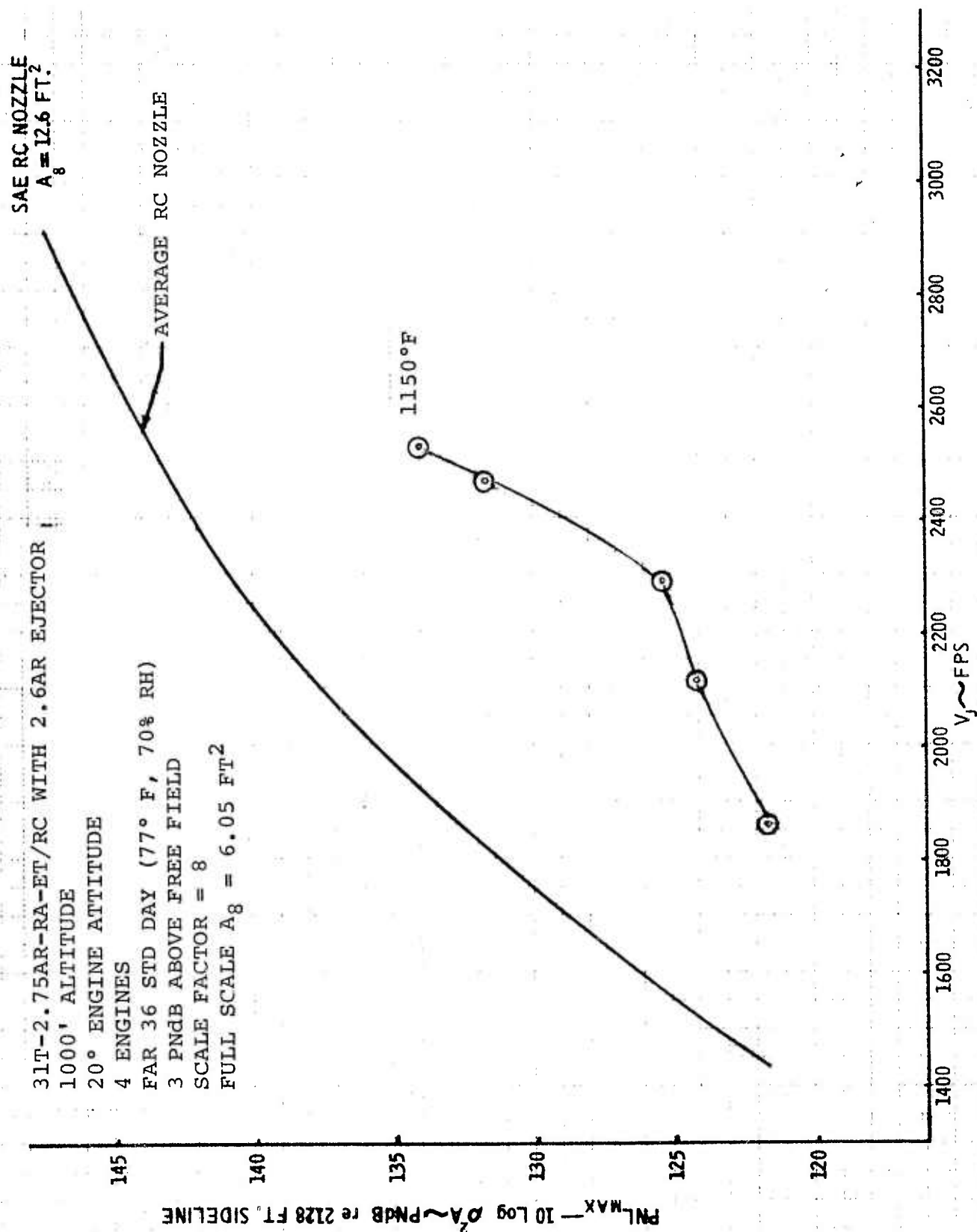


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (dB)
○	65G	1150° F	2.000	130°	SOFP	109.7
●	65G	1150	2.500		SOFP	109.7
x	65G	1150	3.000		SOFP	115.7
*	65G	1150	4.000		SOFP	120.7
					SOFP	130.4

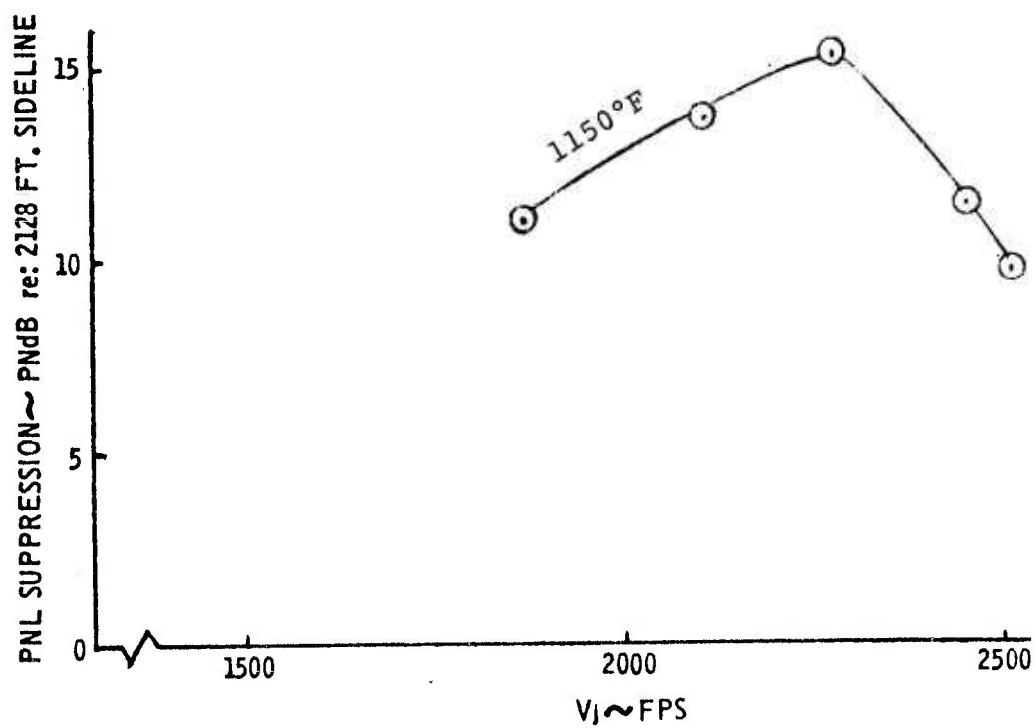
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	65	2.00	1150 °F
◆	65	2.50	1150
○	65	3.00	1150
▼	65	4.00	1150

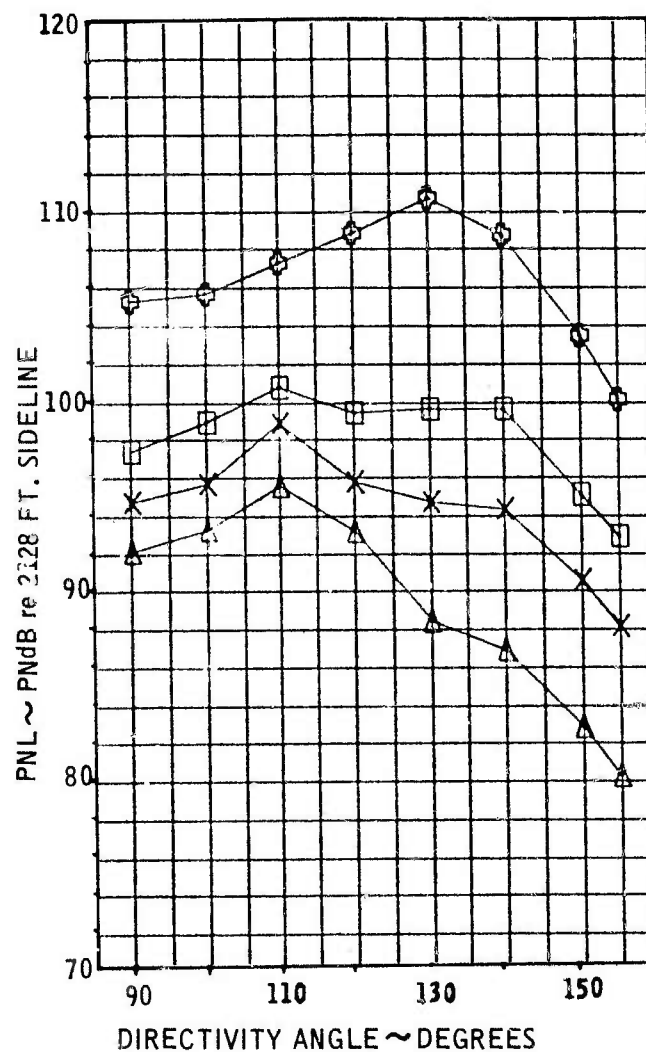


31T-2.75AR-RA-ET/RC WITH 2.6AR EJECTOR



PEAK PNL SUPPRESSION VALUES

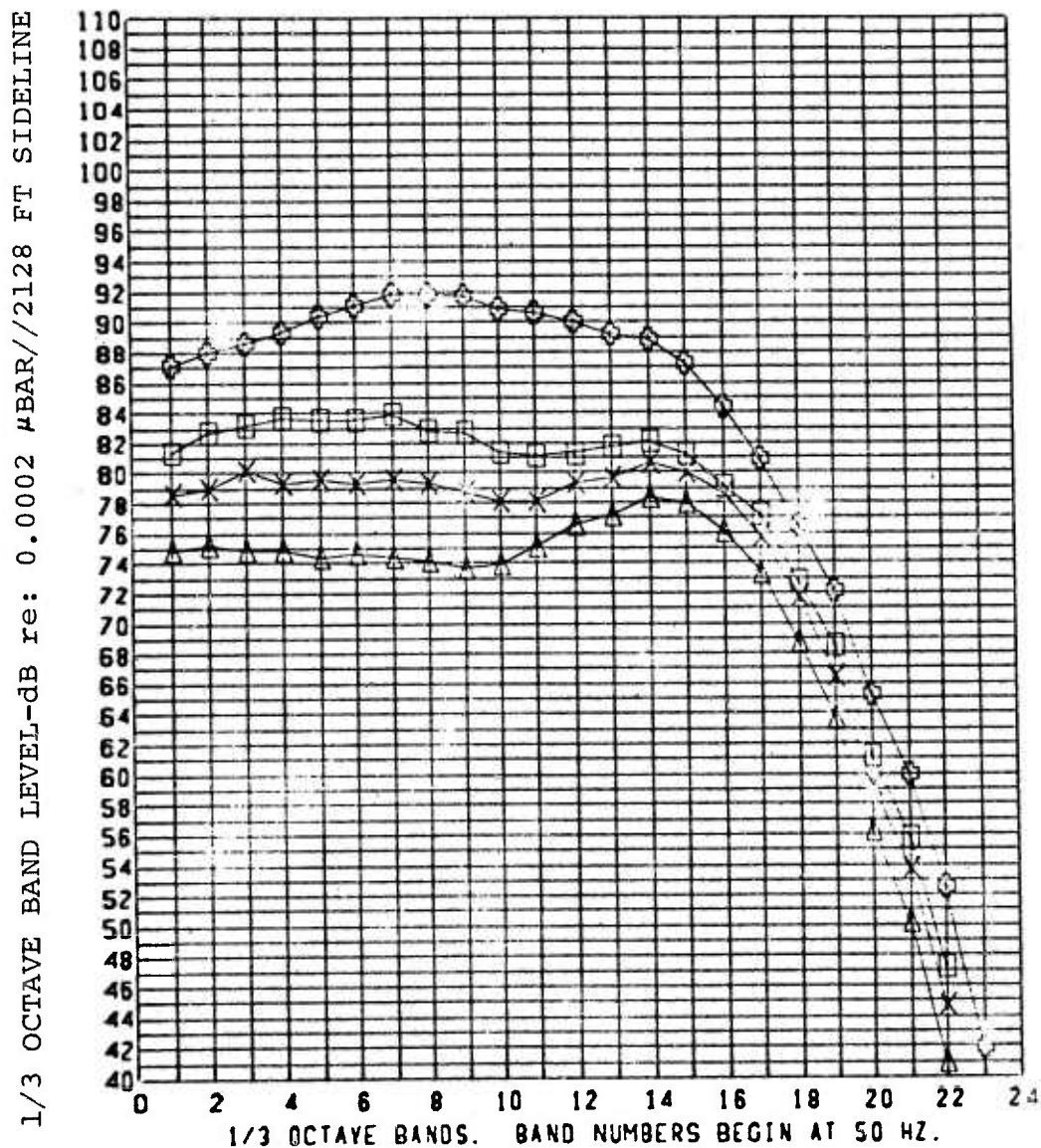
NOZZLE: 31T-2.75AR-RA-ET/RC
WITH 2.6AR EJECTOR



$T_t = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN:65
PR = Δ 2.0, \times 2.5, \square 3.0, \oplus 4.0

PNL BEAM PATTERNS

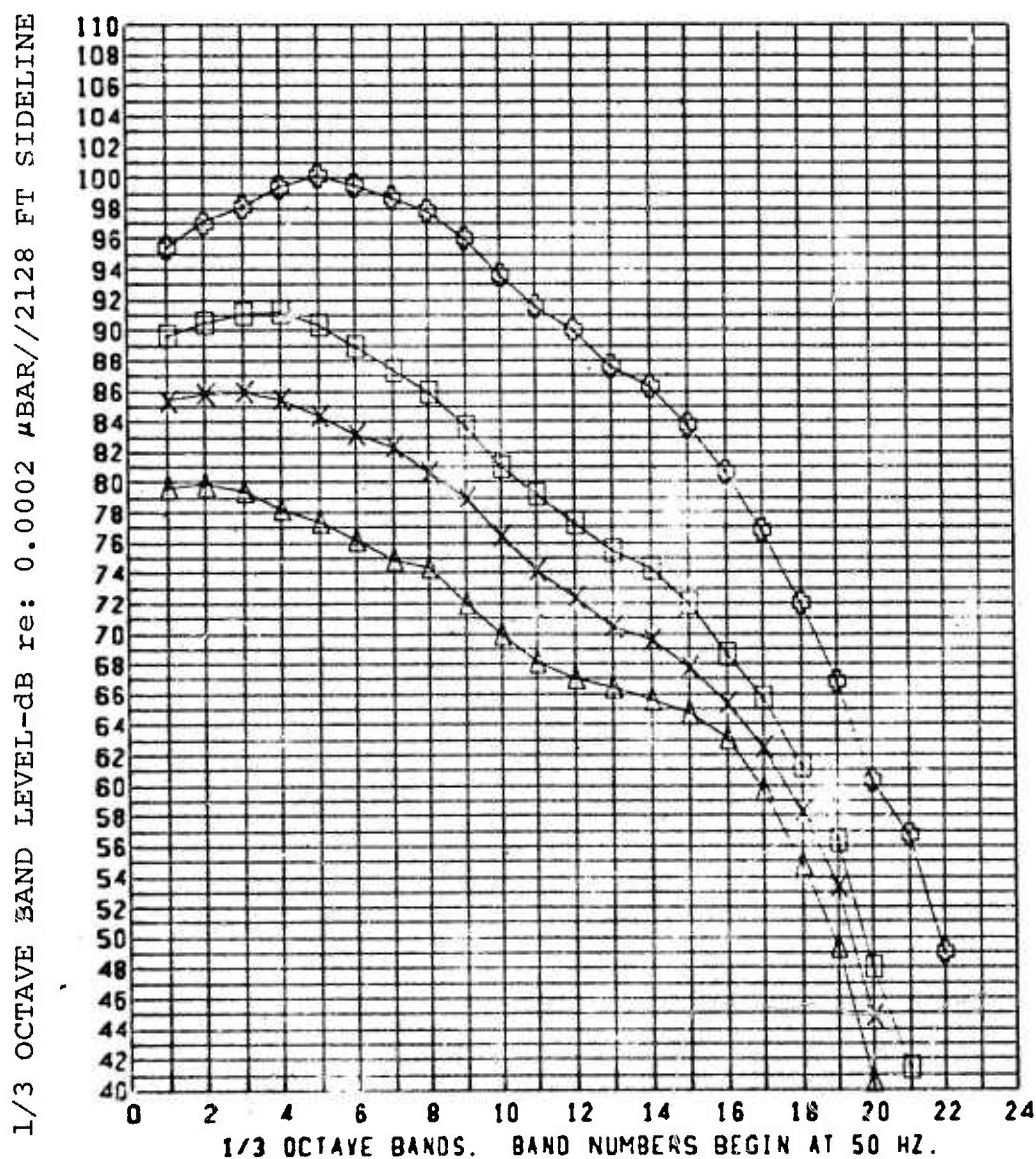
ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



TT = 1150°F A8 = 6.05 FT² RUN: 65
 PR = Δ 2.0, X 2.5, □ 3.0, + 4.0 ◇ 3.7

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



TT = 1150°F A8 = 6.05 FT² RUN: 65
 PR = Δ 2.0, X 2.5, □ 3.0, + 4.0

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC
with 3.1AR Ejector

FACILITY: HNTF

DATE: 9-21-73

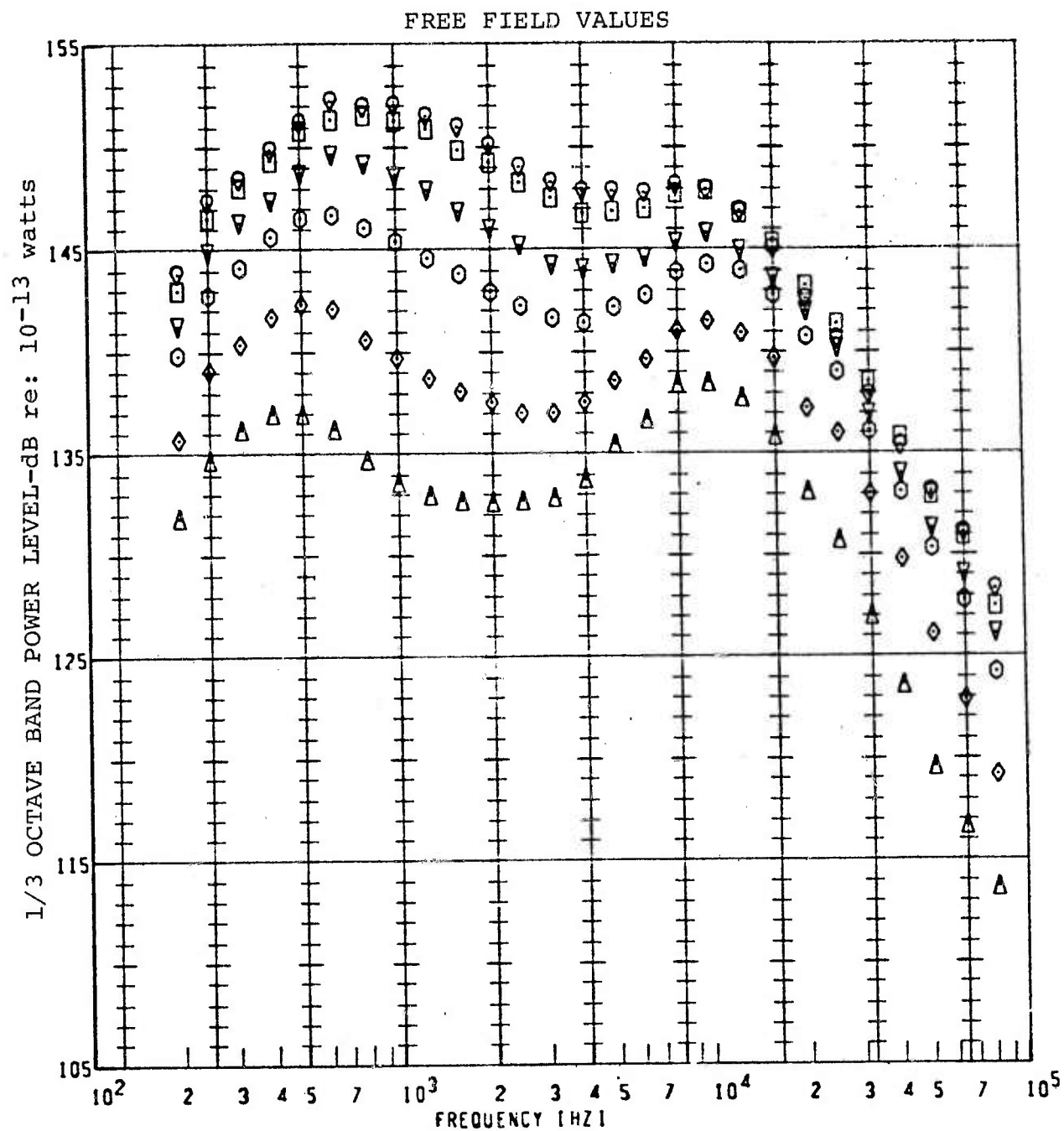
T_{AMB} = 70°F

R.H. = 58%

SCALE MODEL $A_8 = 13.6 \text{ in.}^2$

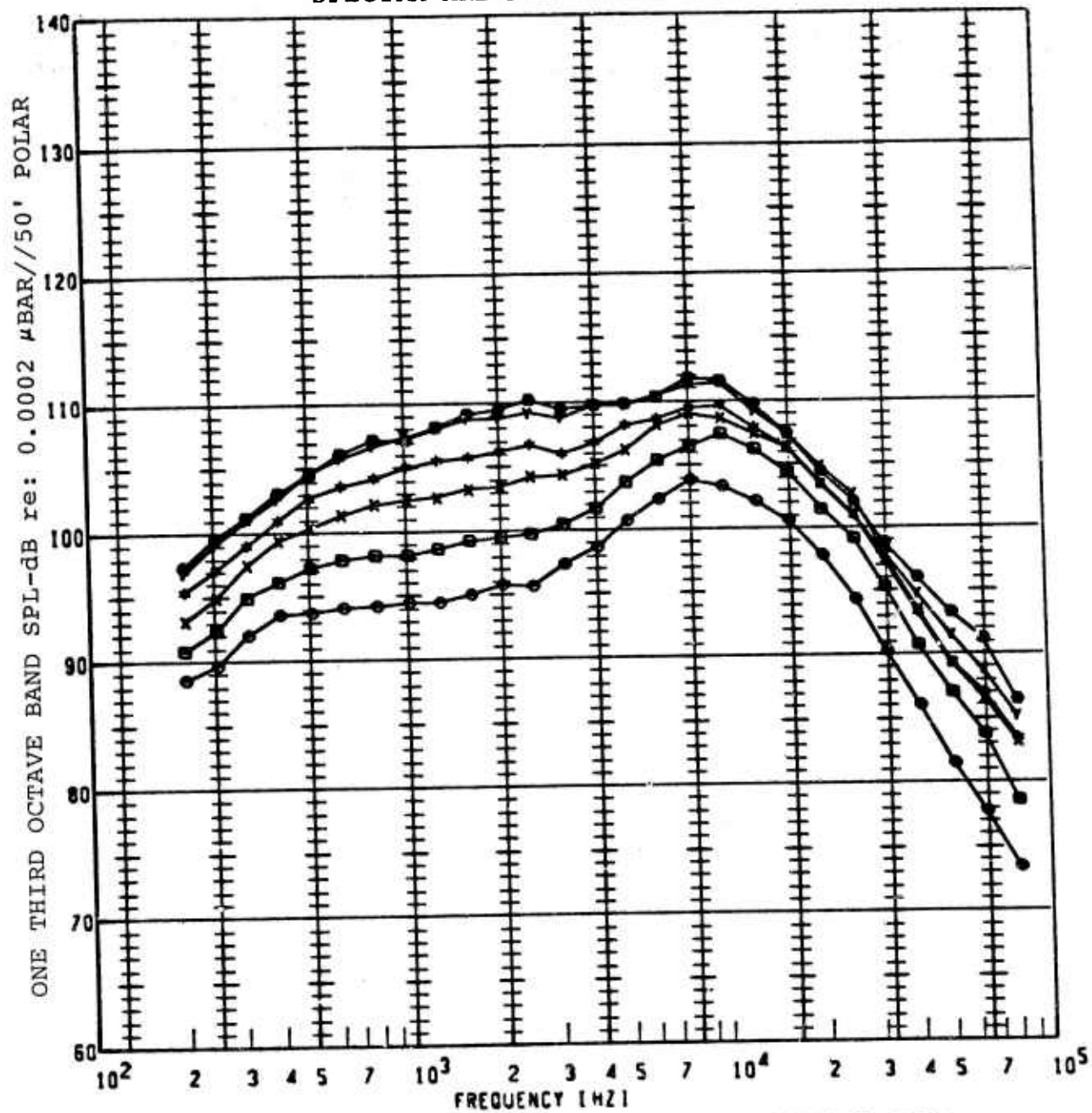
<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
87	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



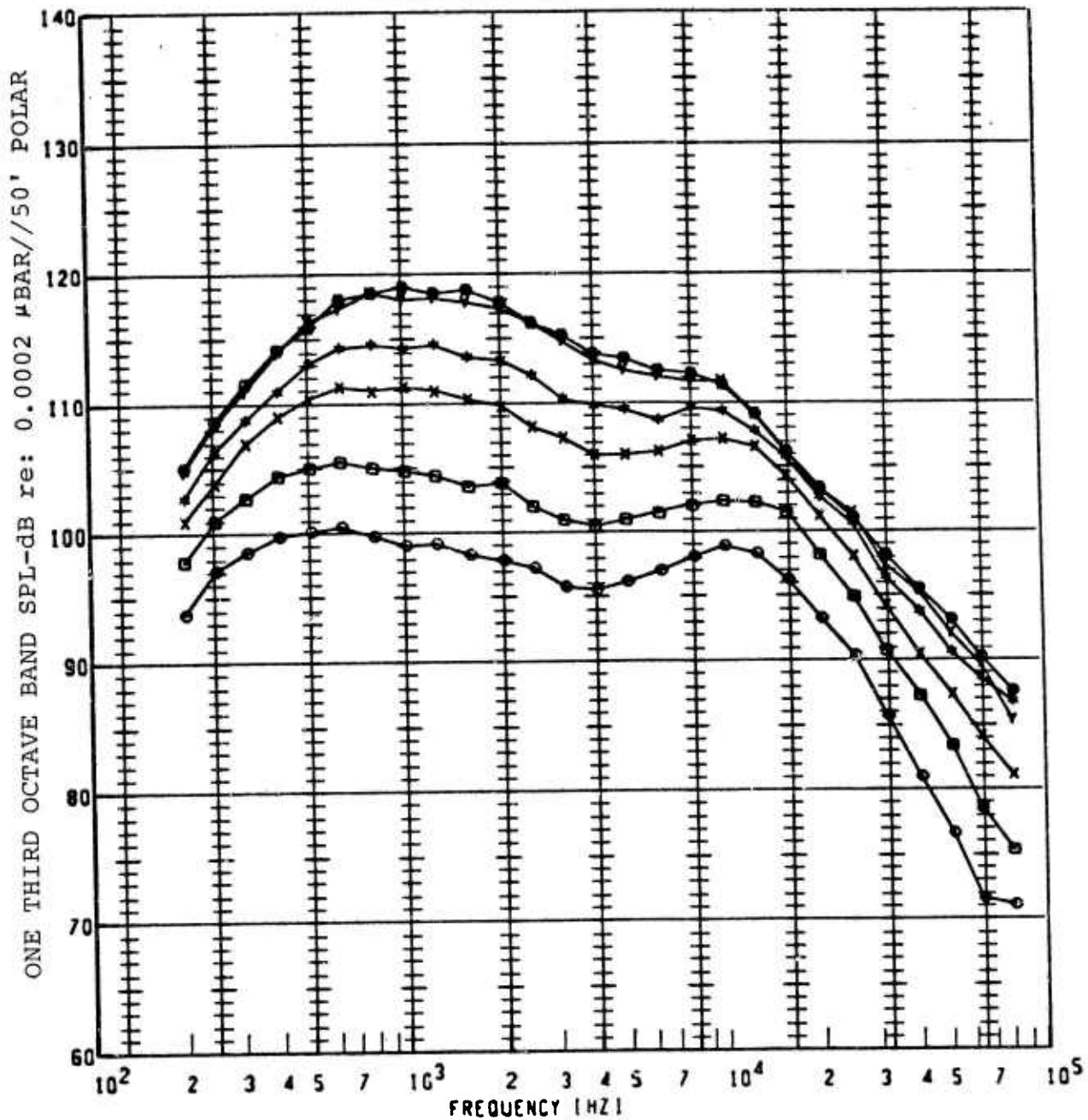
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	87	2.00	1150°
◇	87	2.50	1150
○	87	3.00	1150
▽	87	3.40	1150
□	87	3.70	1150
⊙	87	4.00	1150

SPECTRA ARE FREE FIELD + 6dB



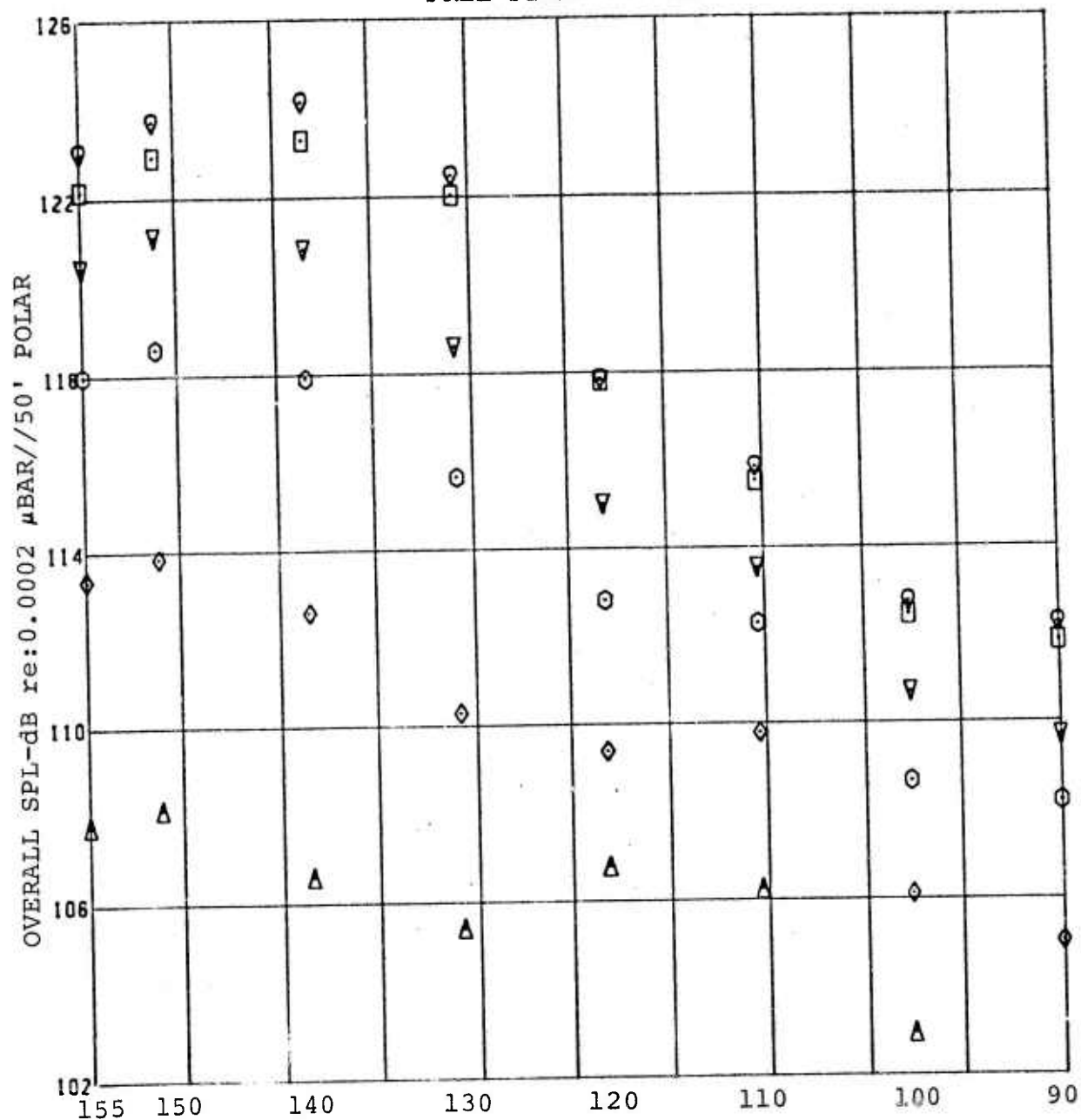
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [dB]
●	87G	1150	2.000	110°	50FP	111.9
○	87G	1150	2.500	↓	50FP	115.4
x	87G	1150	3.000	↓	50FP	118.0
*	87G	1150	3.400	↓	50FP	119.3
y	87G	1150	3.700	↓	50FP	121.3
■	87G	1150	4.000	↓	50FP	121.6

SPECTRA ARE FREE FIELD + 6dB

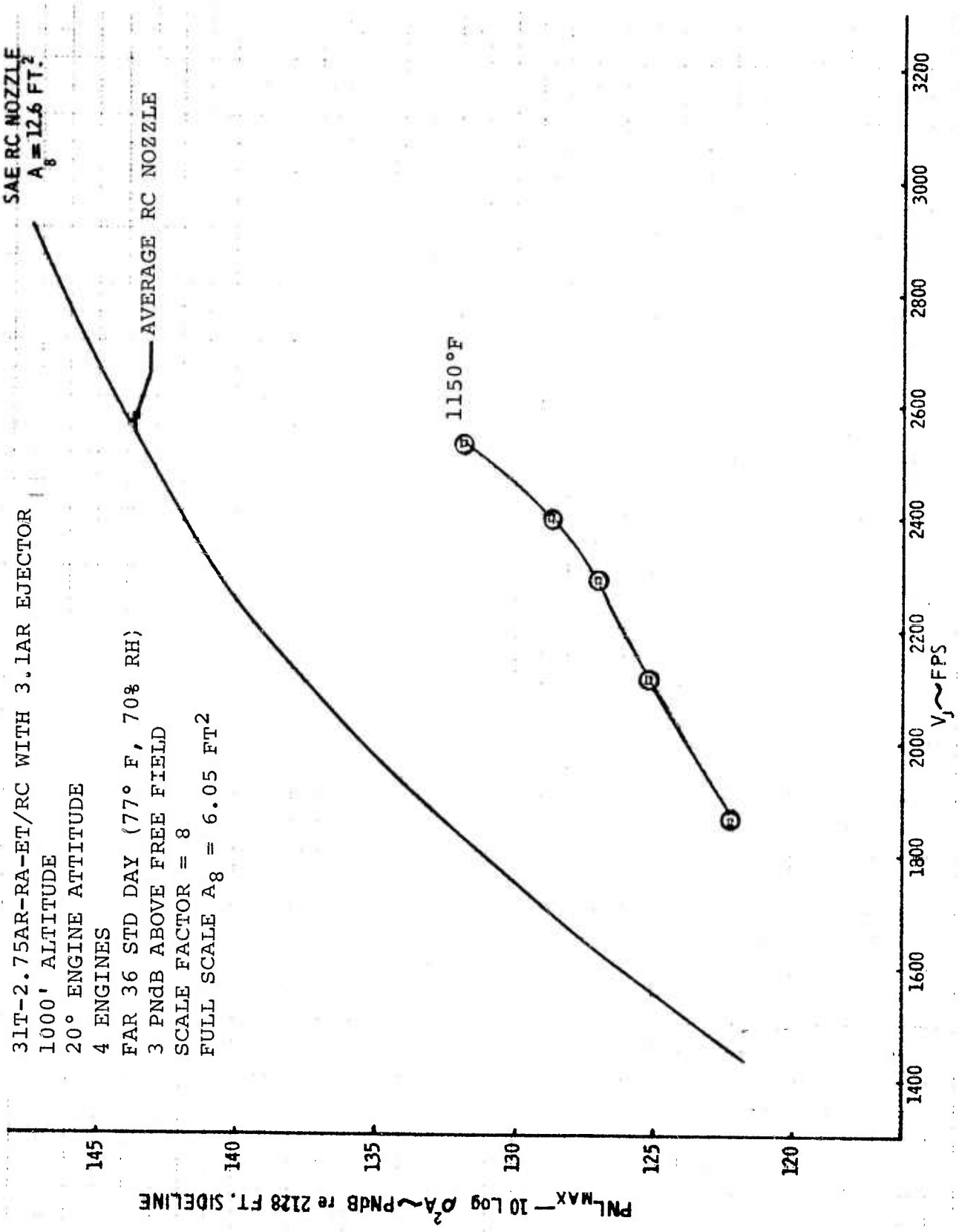


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OSPL (DB)
●	87G	1150	2.000	130°	SOFP	111.3
■	87G	1150	2.500	↓	SOFP	116.2
x	87G	1150	3.000	↓	SOFP	121.6
*	87G	1150	3.400	↓	SOFP	124.6
γ	87G	1150	3.700	↓	SOFP	128.0
●	87G	1150	4.000	↓	SOFP	128.4

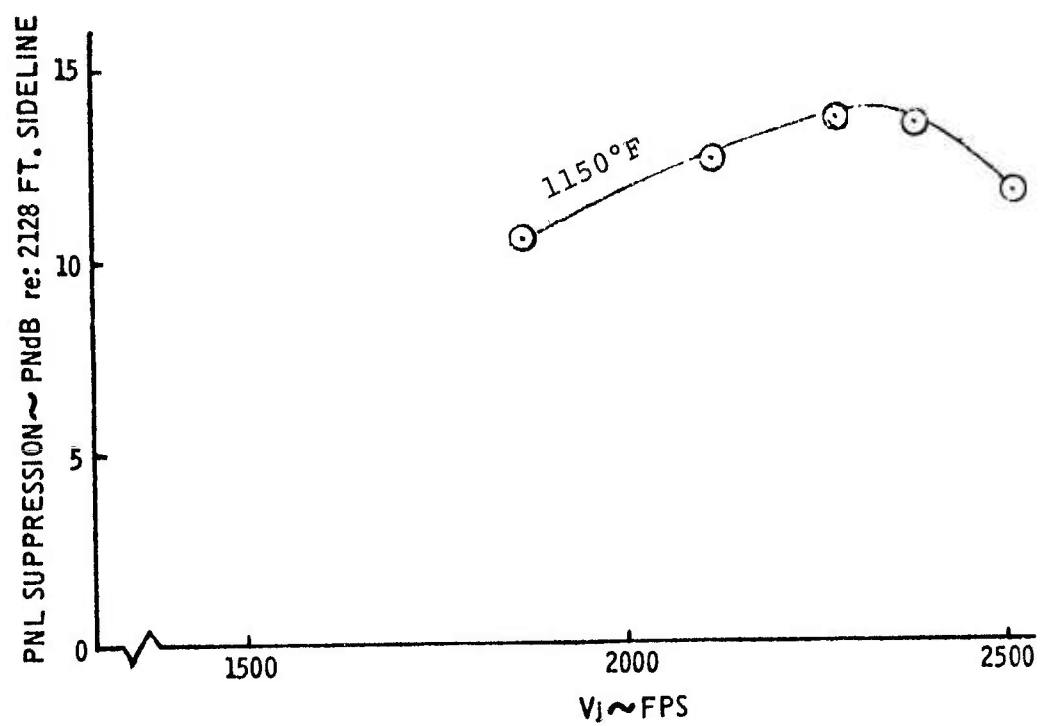
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	87	2.00	1150 °F
◇	87	2.50	1150
○	87	3.00	1150
▽	87	3.40	1150
□	87	3.70	1150
⊙	87	4.00	1150

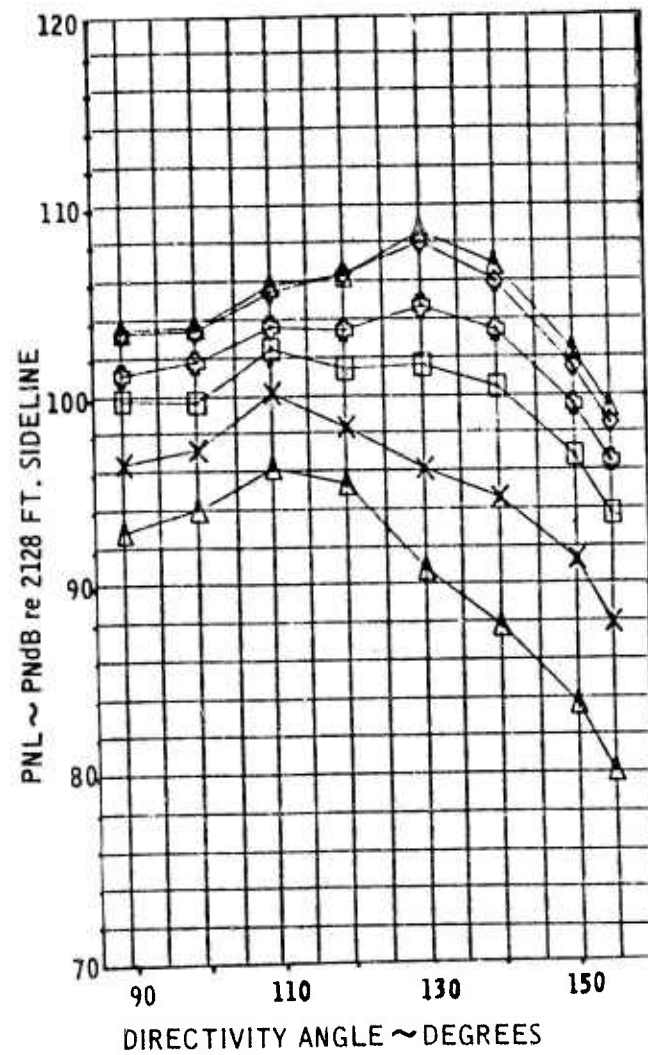


31T-2.75AR-RA-ET/RC WITH 3.1AR EJECTOR



PEAK PNL SUPPRESSION VALUES

NOZZLE: 31T-2.75AR-RA-ET/RC
WITH 3.1AR EJECTOR

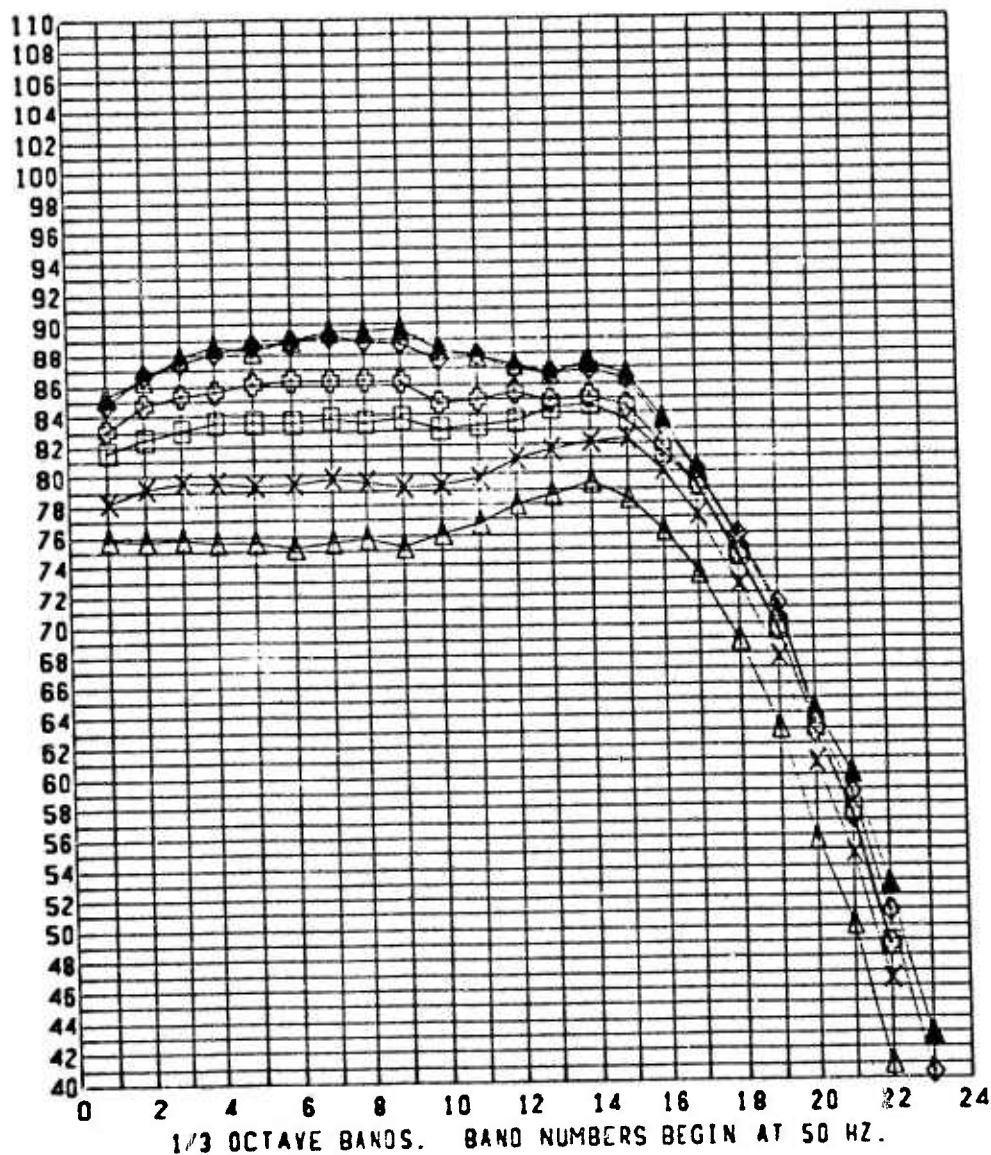


Tt = 1150°F As = 6.05 FT² RUN: 87
PR = Δ 2.0, X 2.5, □ 3.0, + 3.4, ◇ 3.7, ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

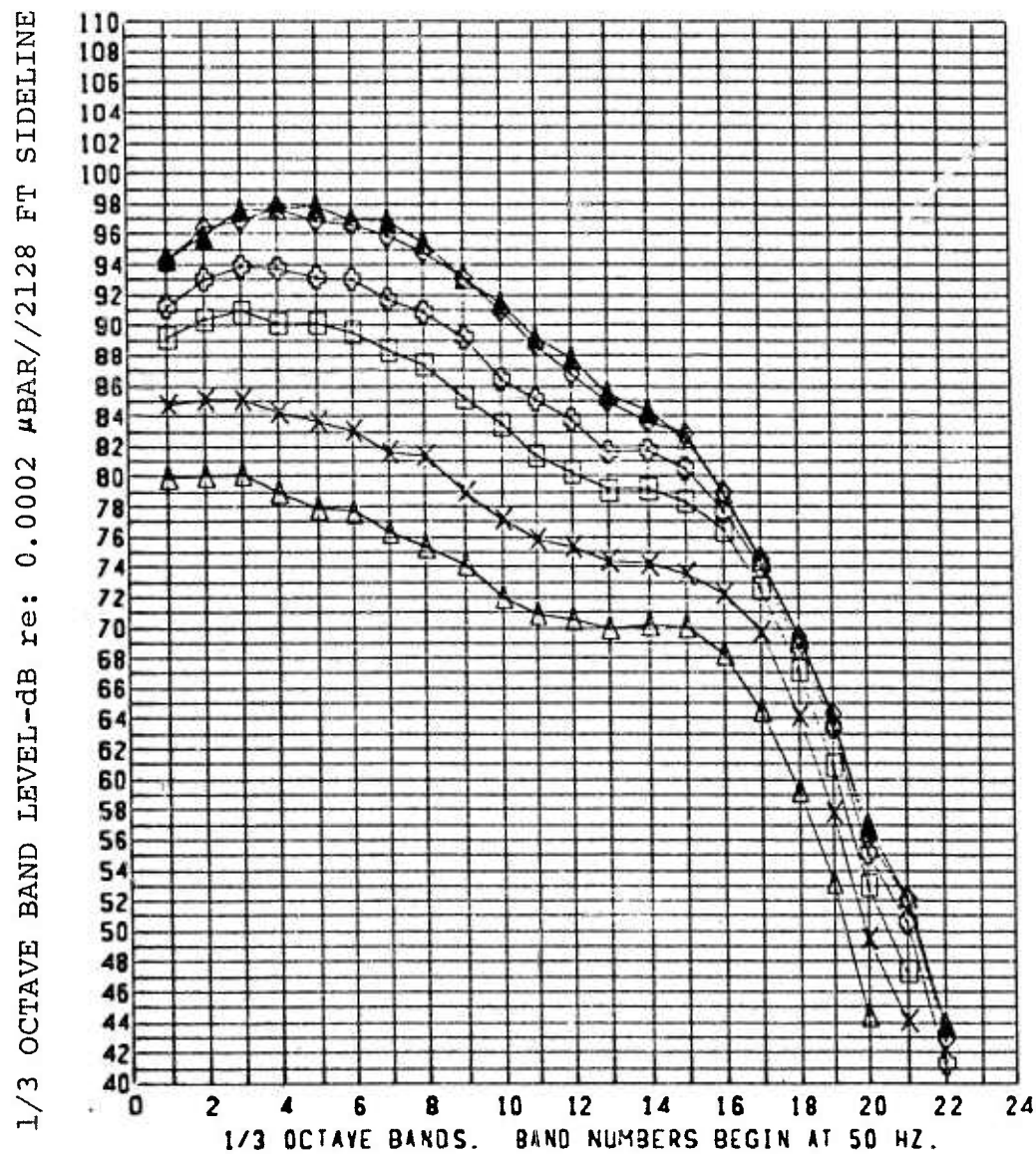
1/3 OCTAVE BAND LEVEL-DB re: 0.0002 μ BAR/2128 FT SIDELINE



TT = 1150°F A8 = 6.05 FT² RUN: 87
 PR = Δ 2.0, X 2.5, □ 3.0, + 3.4, ◇ 3.7, ▲ 4.0

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



Tt = 1150°F A8 = 6.05 FT² RUN: 87

PR = ▲ 2.0, × 2.5, □ 3.0, + 3.4, ◇ 3.7, ▲ 4.0

TEST CONDITIONS

NOZZLE: 31T-2.75AR-RA-ET/RC
with 3.7AR Ejector

FACILITY: HNTF

DATE: 9-18-73

T_{AMB} = 66°F

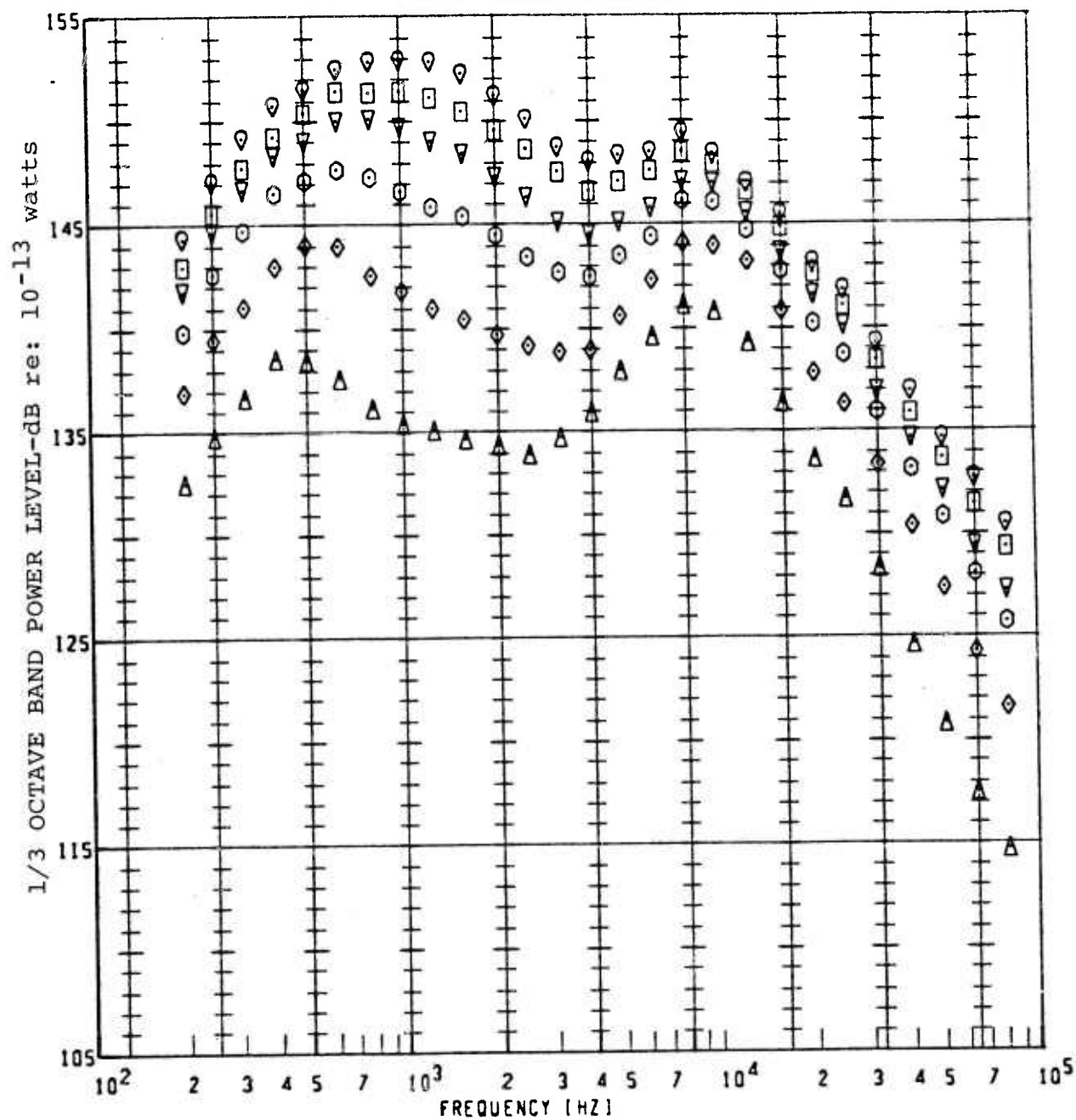
R.H. = 66%

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
81	2.0	1150°F	1875 fps		
"	2.5	"	2126		
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

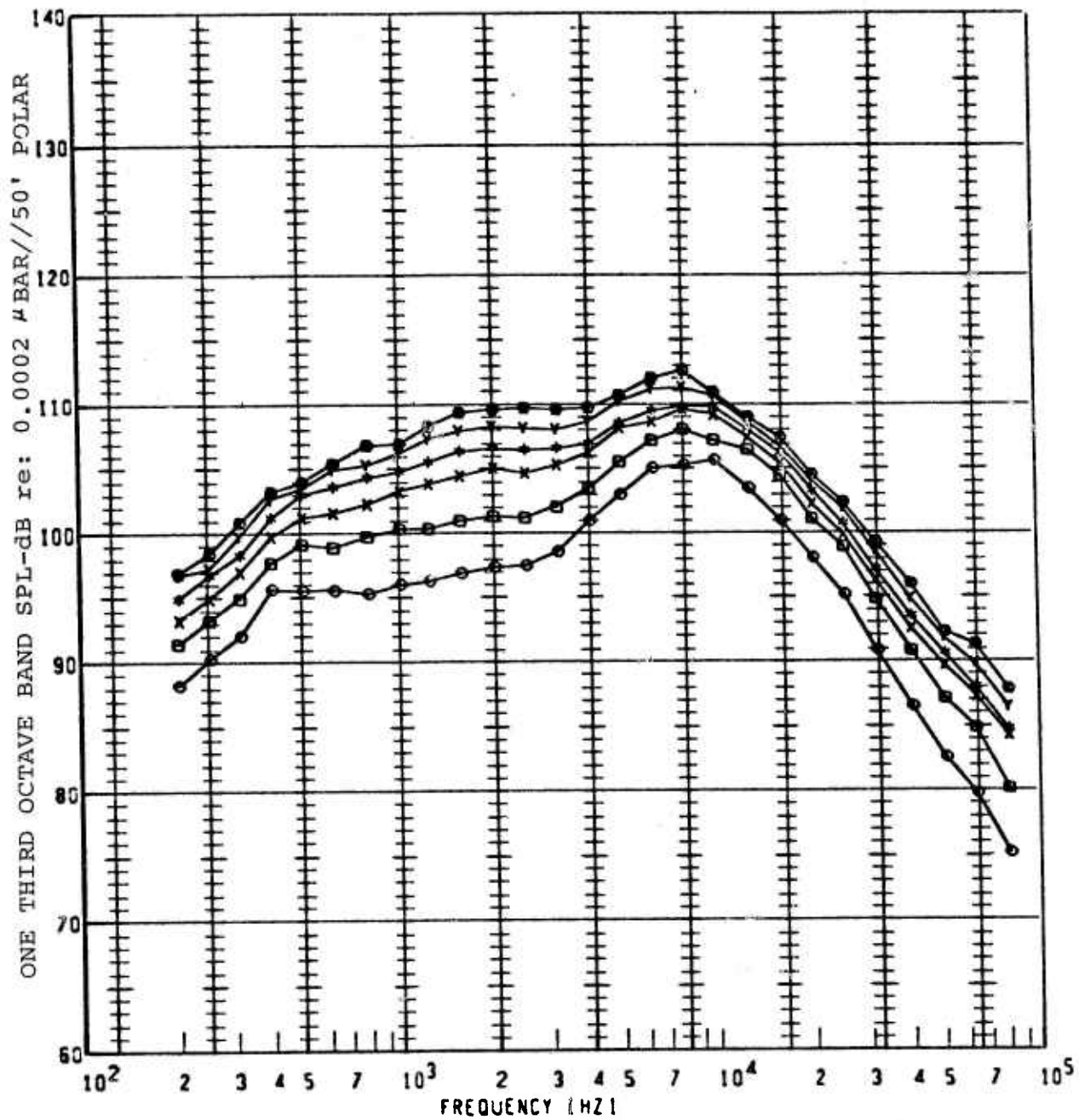
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

FREE FIELD VALUES



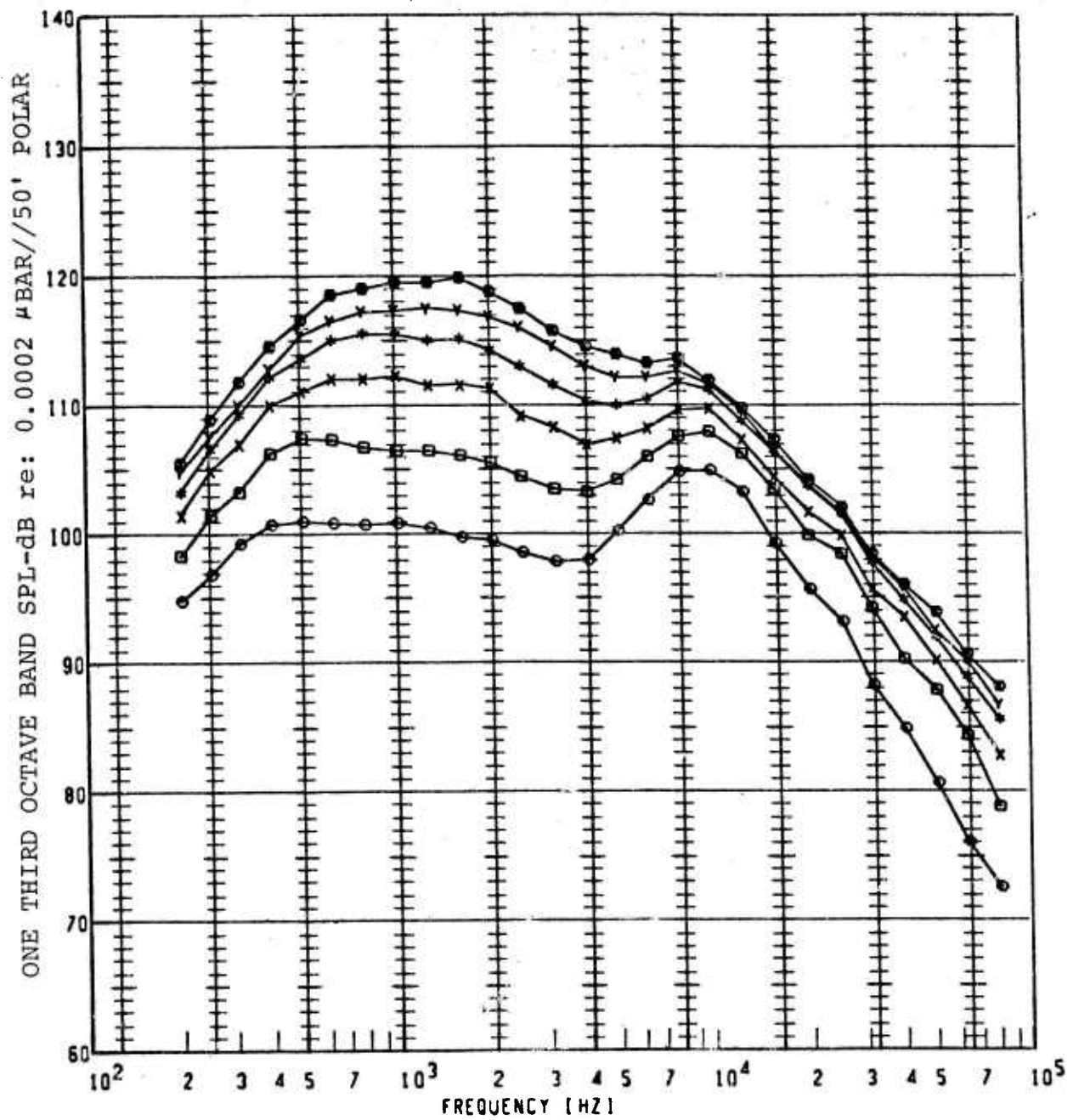
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	81	2.00	1150°F
◇	81	2.50	1150
○	81	3.00	1150
▽	81	3.40	1150
□	81	3.70	1150
◊	81	4.00	1150

SPECTRA ARE FREE FIELD + 6dB



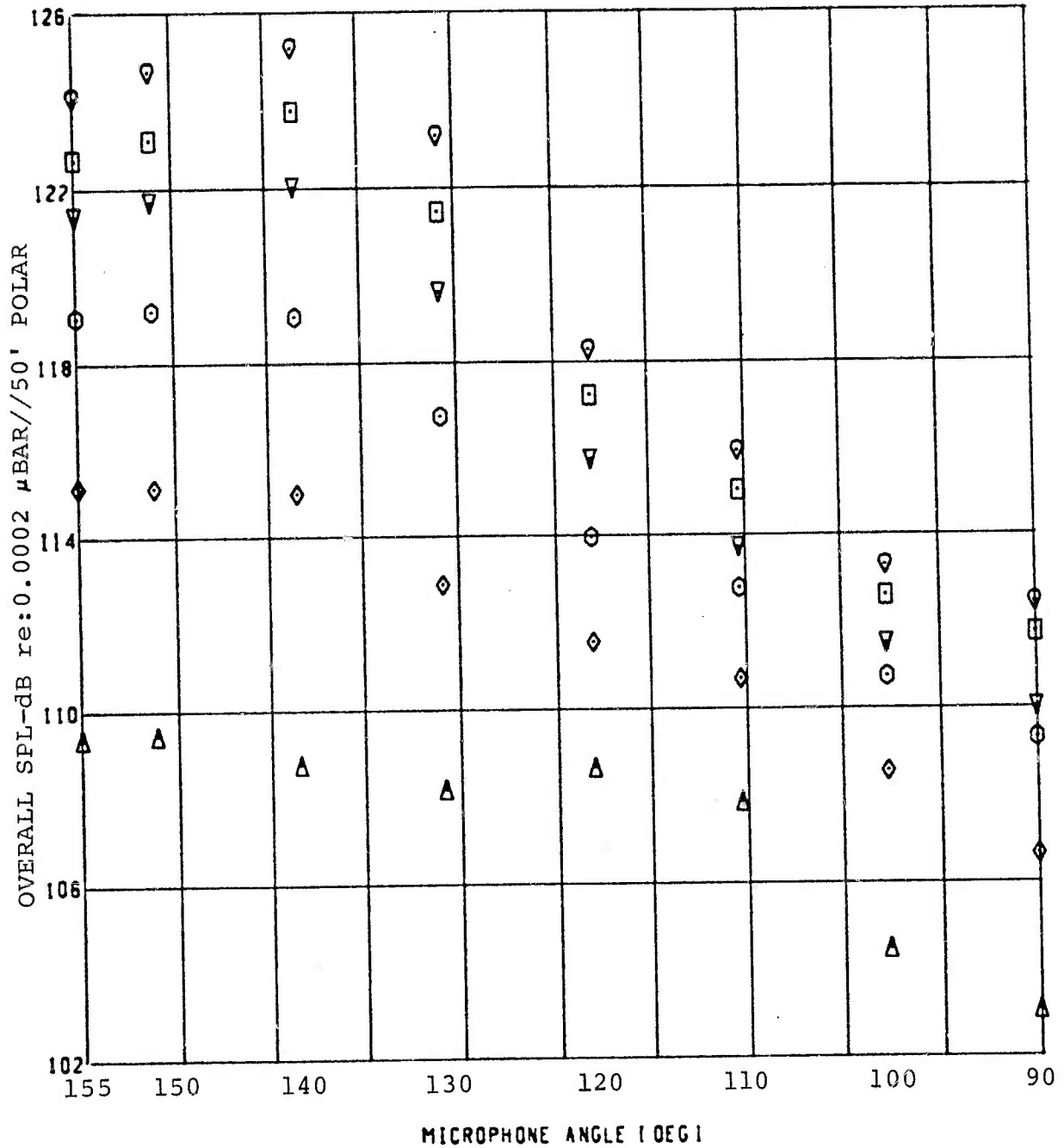
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
●	81G	1150°F	2.000	110°	50FP	113.6
○	81G	1150	2.500	↓	50FP	116.4
x	81G	1150	3.000	↓	50FP	118.5
*	81G	1150	3.400	↓	50FP	119.5
y	81G	1150	3.700	↓	50FP	120.9
■	81G	1150	4.000	↓	50FP	121.8

SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL 1081
○	81G	1150° F	2.000	130°	50FP	114.0
□	81G	1150	2.500		50FP	118.7
x	81G	1150	3.000		50FP	122.7
*	81G	1150	3.400		50FP	125.6
+	81G	1150	3.700		50FP	127.4
●	81G	1150	4.000		50FP	129.2

FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
Δ	81	2.00	1150 °F
◊	81	2.50	1150
○	81	3.00	1150
▽	81	3.40	1150
◻	81	3.70	1150
◉	81	4.00	1150

SAE RC NOZZLE
 $A_8 = 12.6 \text{ FT}^2$

AVERAGE RC NOZZLE

31T-2.75AR-RA-ET/RC WITH 3.7AR EJECTOR

1000' ALTITUDE

20° ENGINE ATTITUDE

4 ENGINES

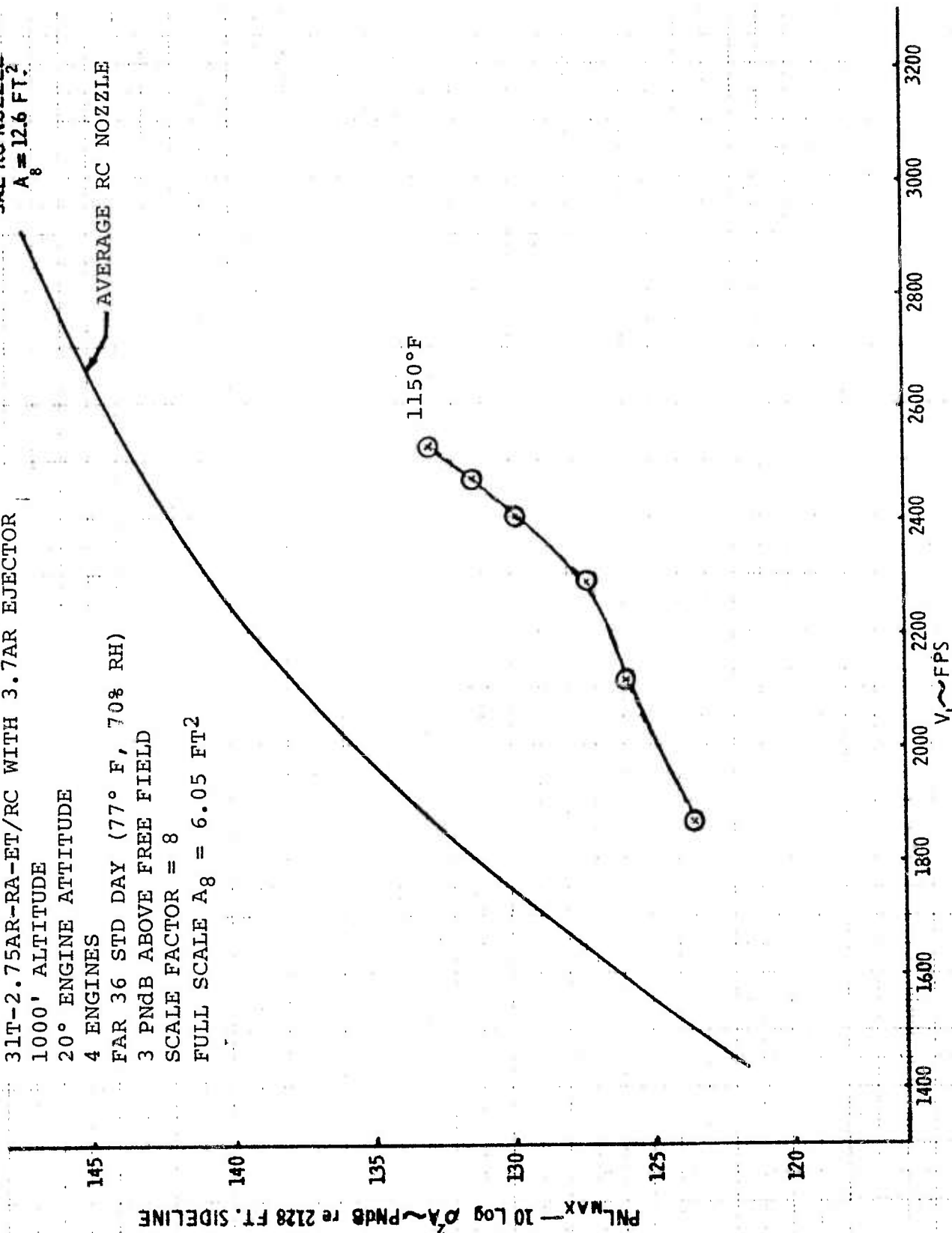
FAR 36 STD DAY (77° F, 70% RH)

3 PNDB ABOVE FREE FIELD

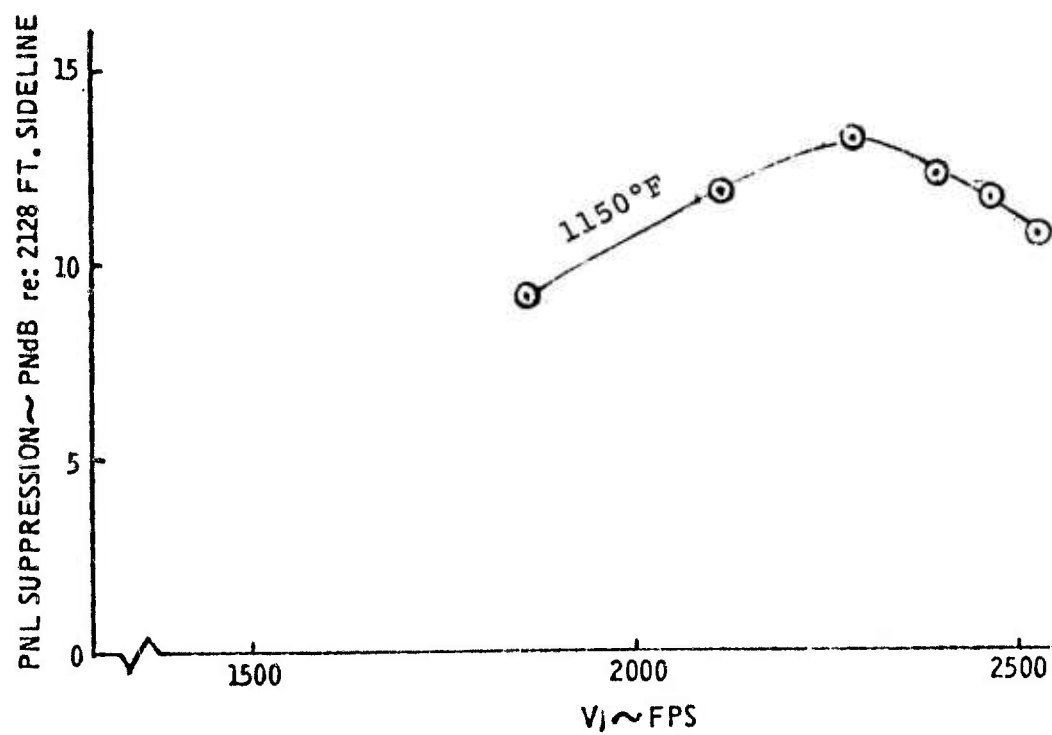
SCALE FACTOR = 8

FULL SCALE $A_8 = 6.05 \text{ FT}^2$

1150°F

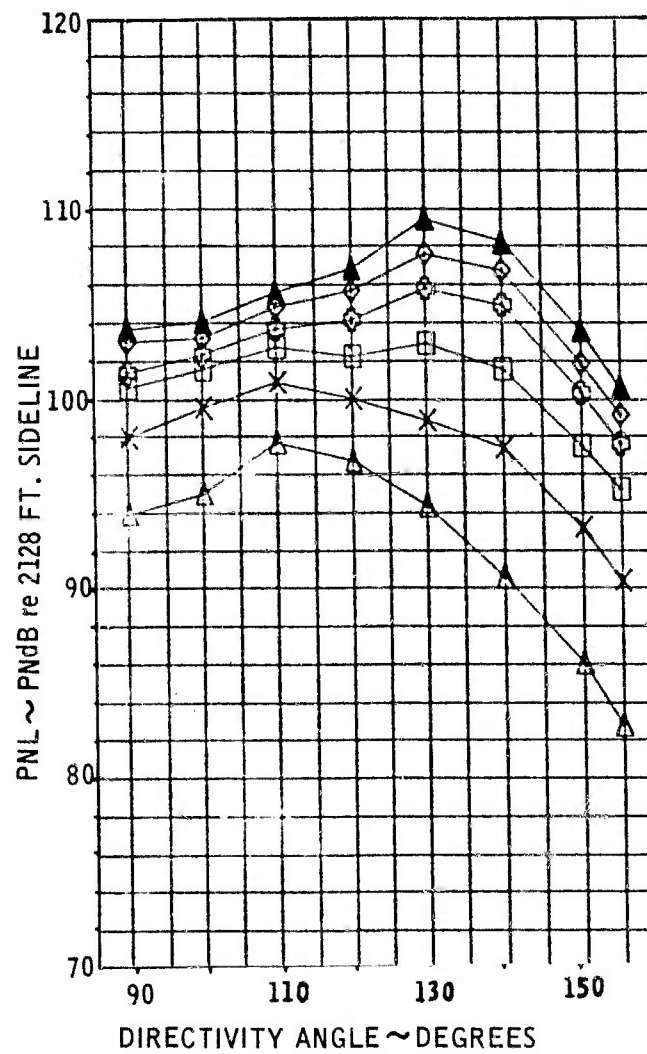


31T-2.75AR-RA-ET/RC WITH 3.7AR EJECTOR



PEAK PNL SUPPRESSION VALUES

NOZZLE: 31T-2.75AR-RA-ET/RC
WITH 3.7AR EJECTOR



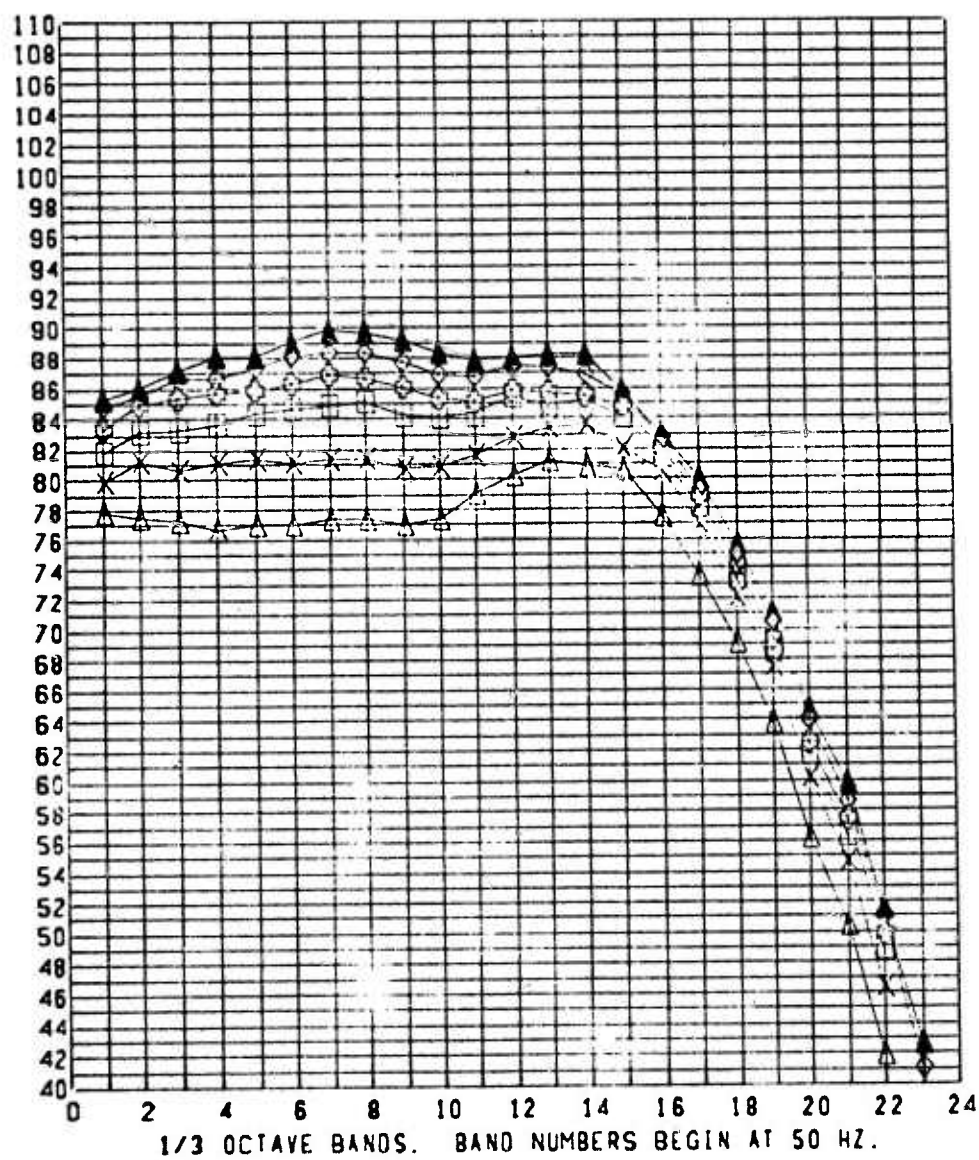
TT = 1150°F A8 = 6.05 FT² RUN: 81
PR = Δ 2.0, X 2.5, □ 3.0, + 3.4, ◇ 3.7 ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR/2128 FT SIDELINE

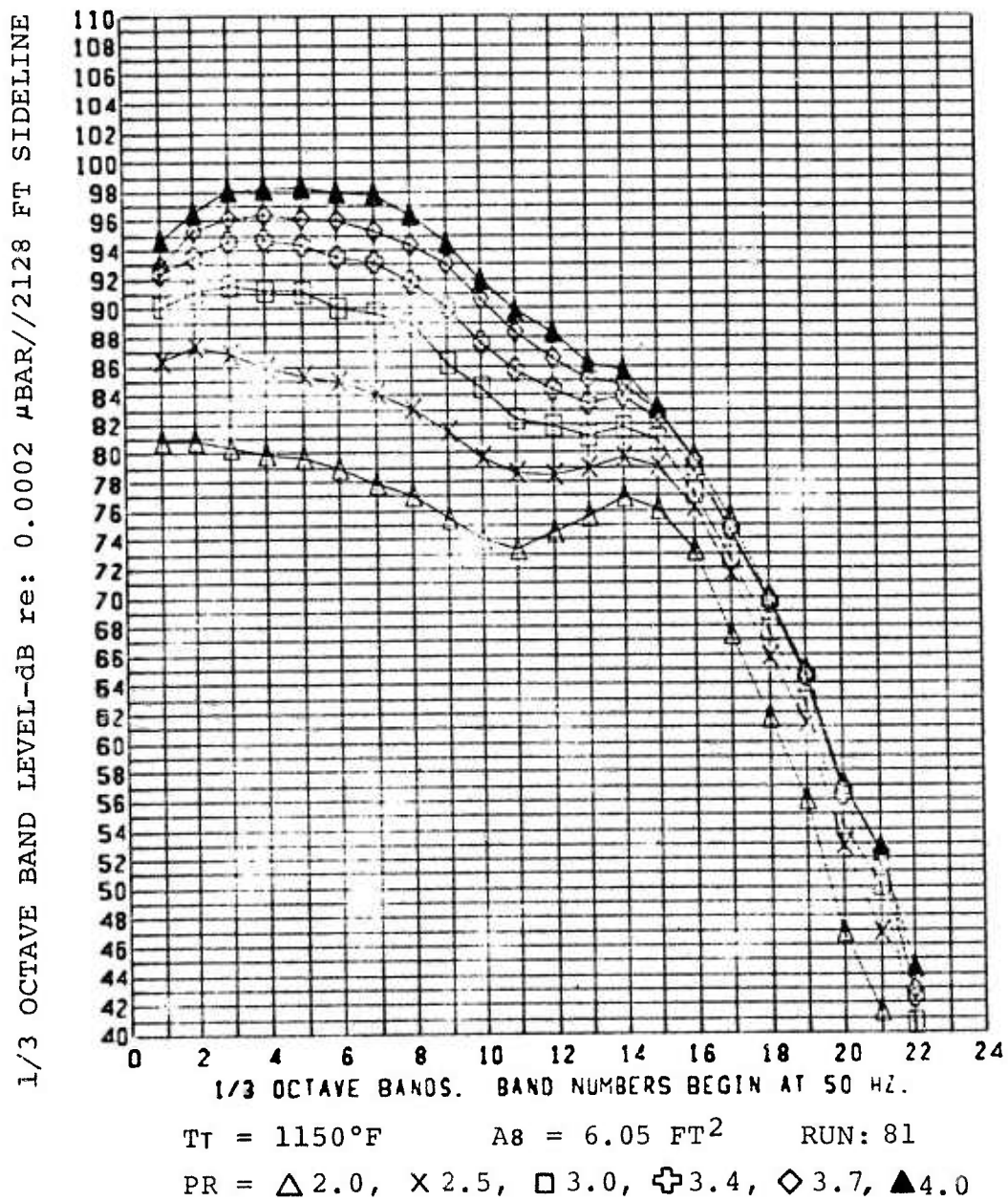


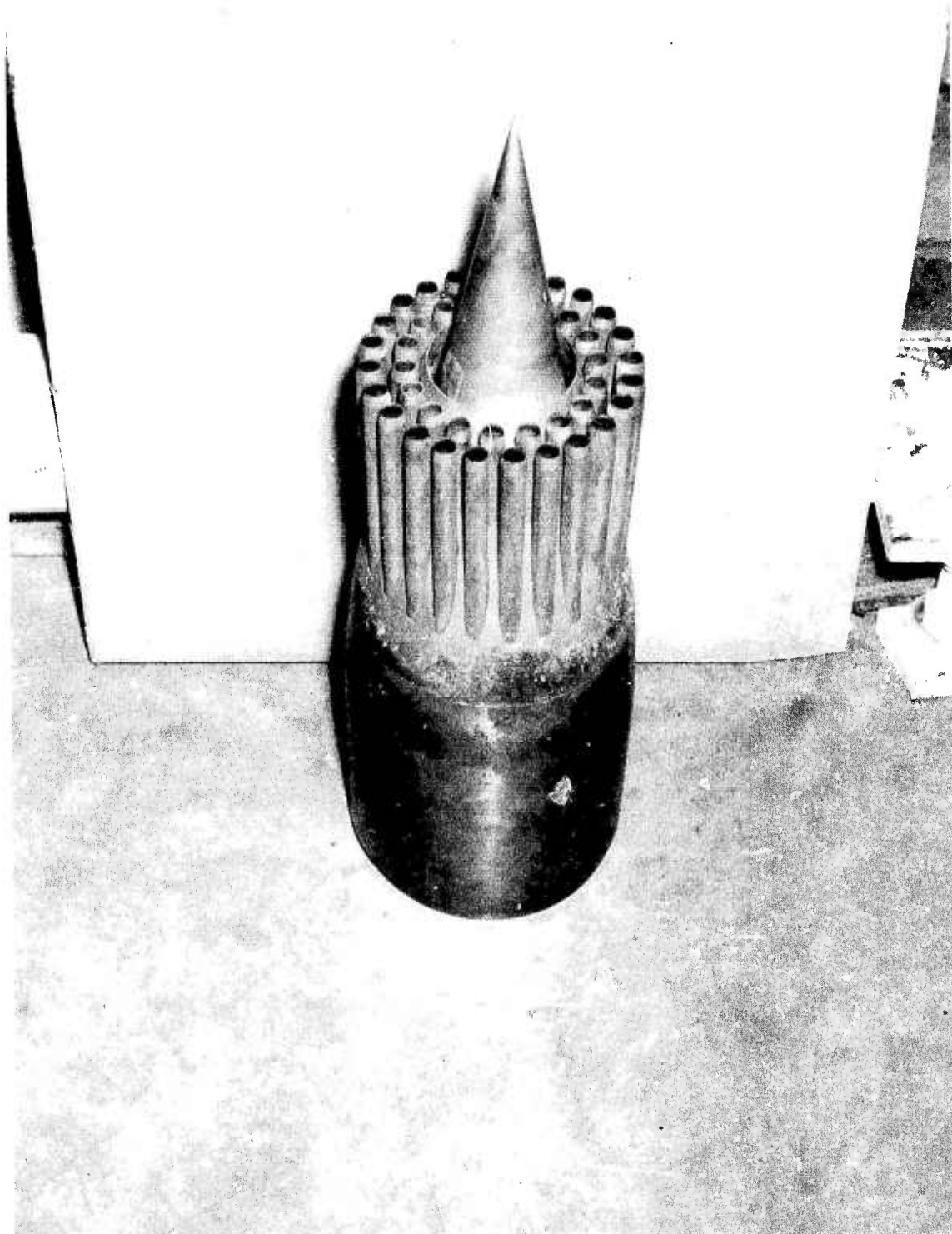
$T_T = 1150^\circ\text{F}$ $A_8 = 6.05 \text{ FT}^2$ RUN: 81

PR = \triangle 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7, \blacktriangle 4.0

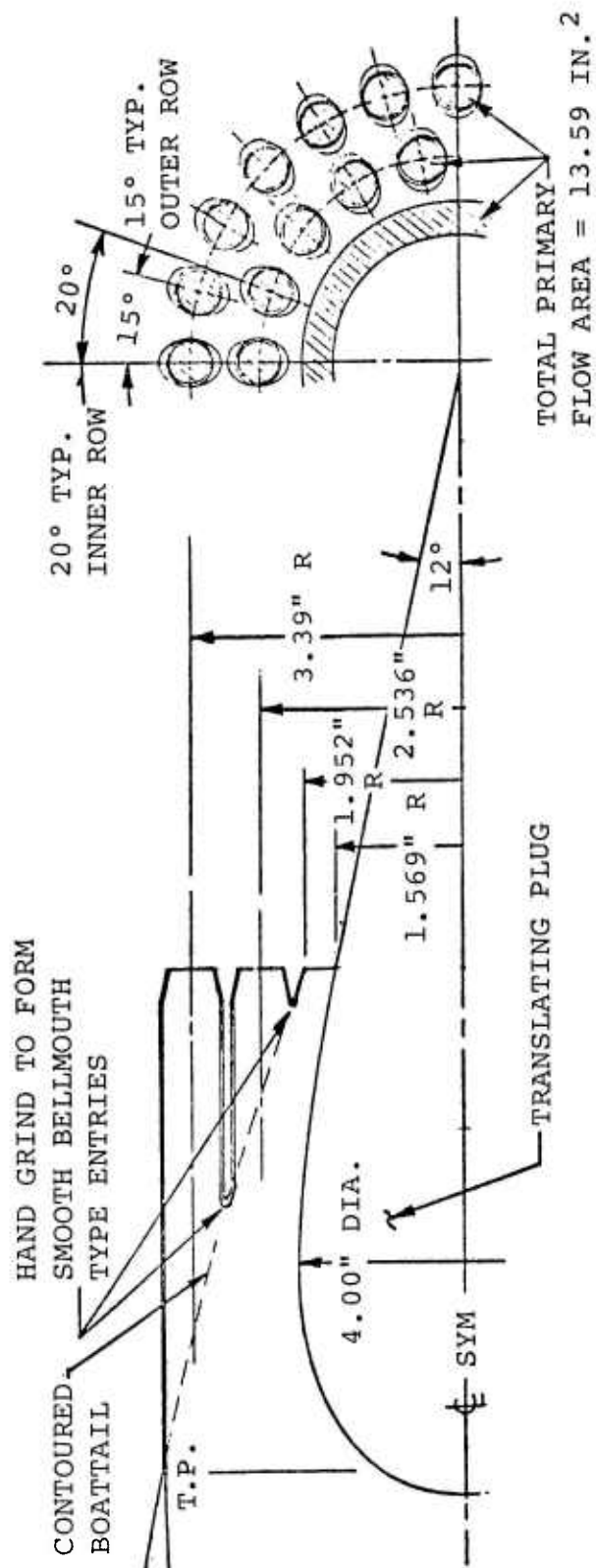
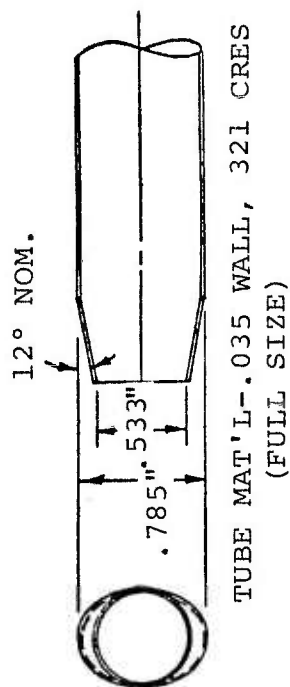
ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT





42T/ANNULUS-3.3AR-CPA-ET/RC NOZZLE
(0.383" WIDE ANNULUS)



42 TUBE - ANNULAR-PLUG NOZZLE

TEST CONDITIONS

NOZZLE: 42T/Annulus-3.3AR-CPA-ET/RC

FACILITY: HNTF

DATE: 10-19-73

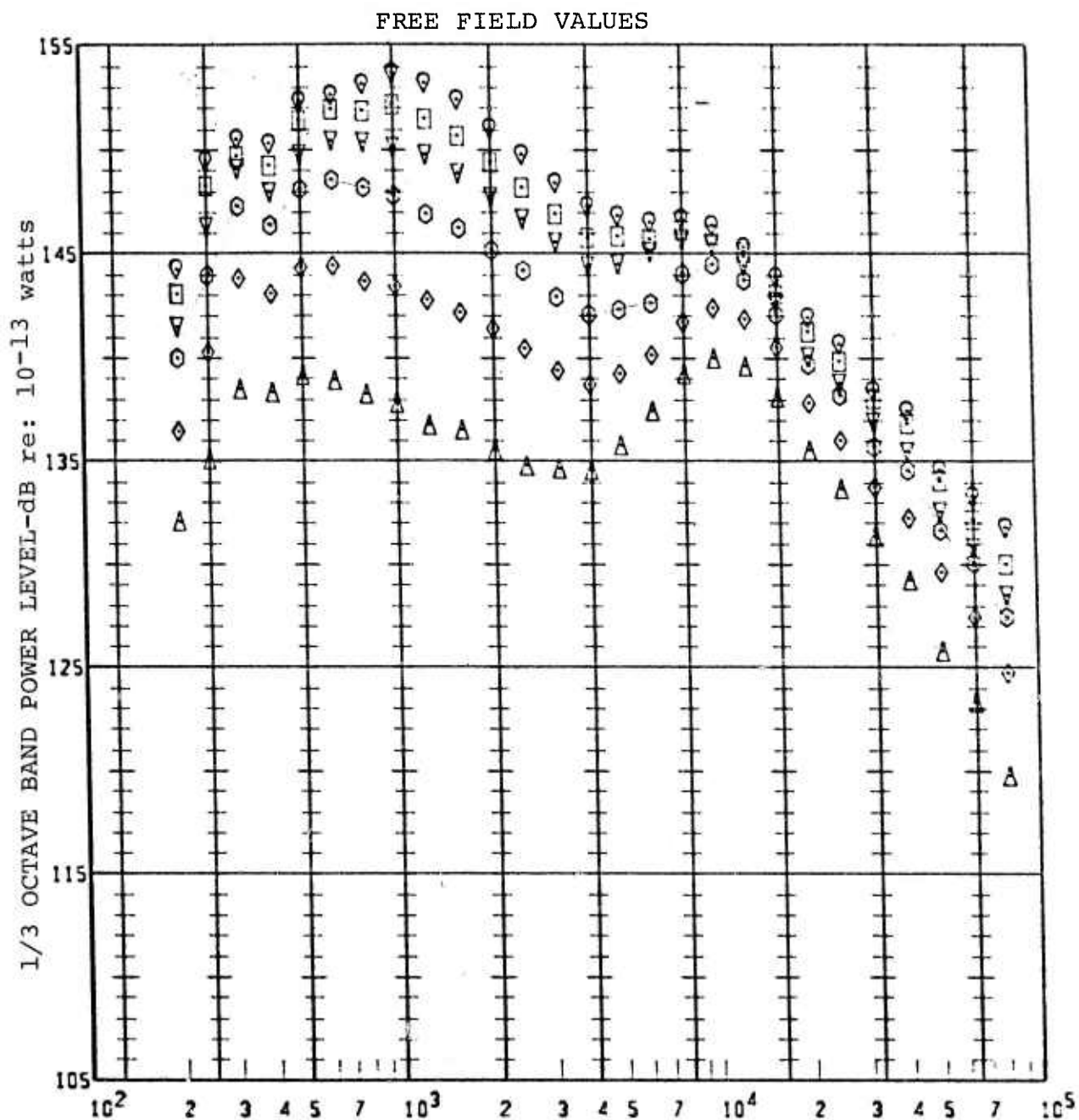
T_{AMB} = 65°F

R.H. = 62%

SCALE MODEL $A_8 = 13.6 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
189	2.0	1150°F	1875 fps	Annulus width =	
"	2.5	"	2126	0.383"	
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

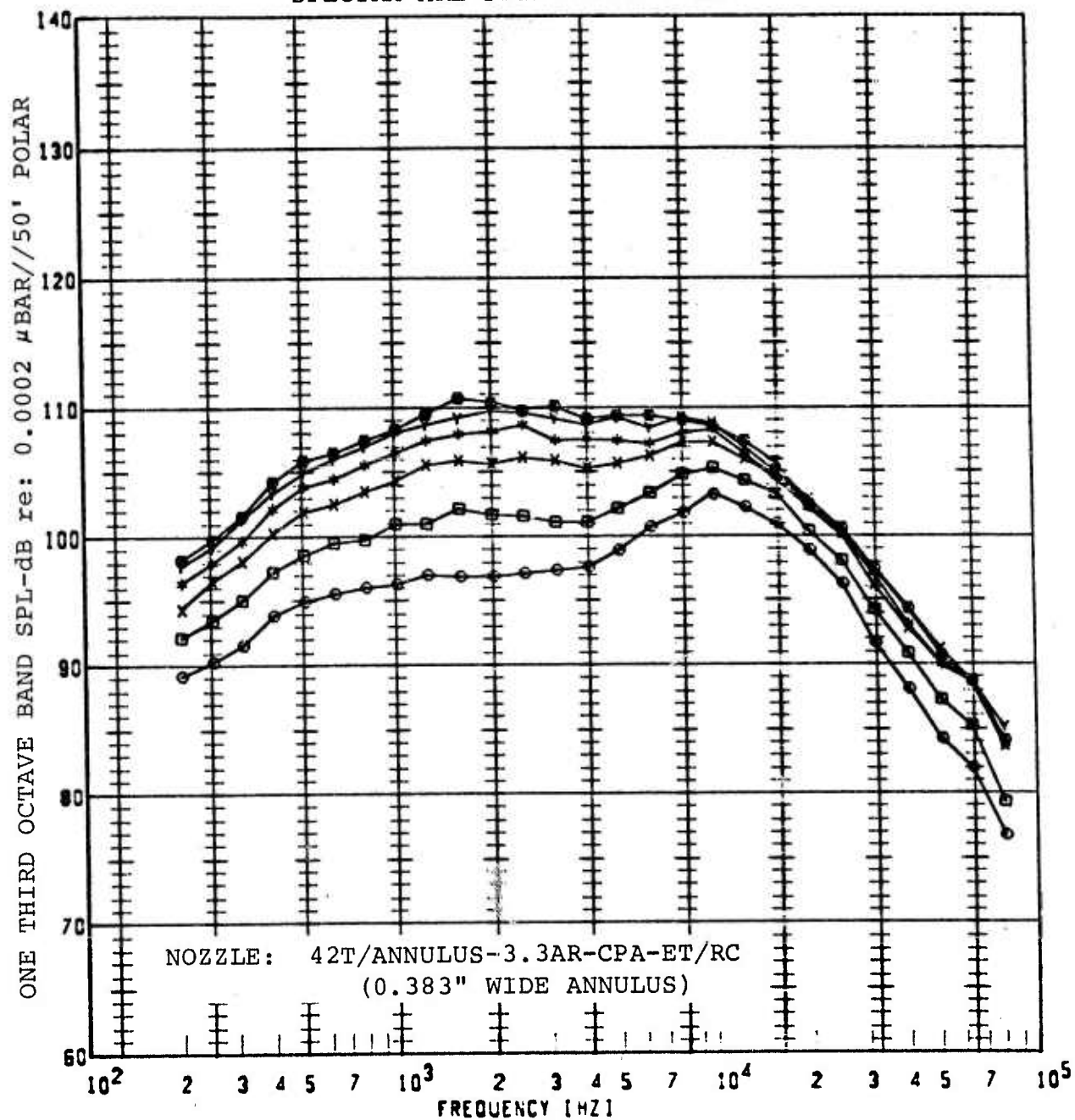


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	189	2.00	1150 °F
◇	189	2.50	1150
○	189	3.00	1150
▽	189	3.40	1150
□	189	3.70	1150
⊙	189	4.00	1150

NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

JET NOISE POWER SPECTRA

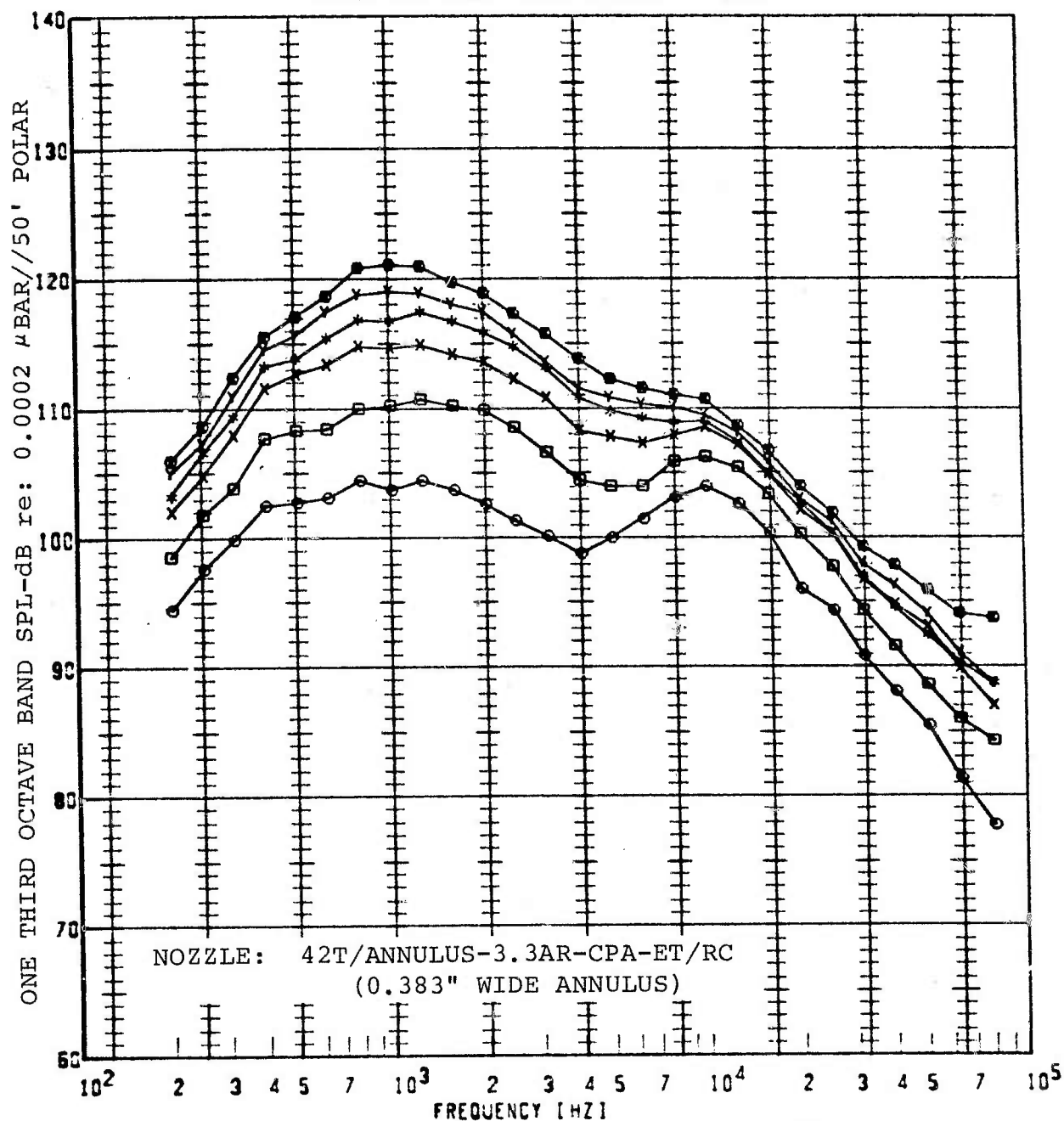
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	DAS2 [dB]
○	189C	1150°F	2.000	110°	50FP	111.8
□	189C	1150	2.500		50FP	114.9
x	189C	1150	3.000		50FP	118.0
*	189C	1150	3.400		50FP	119.5
y	189C	1150	3.700		50FP	120.7
●	189C	1150	4.000		50FP	121.2

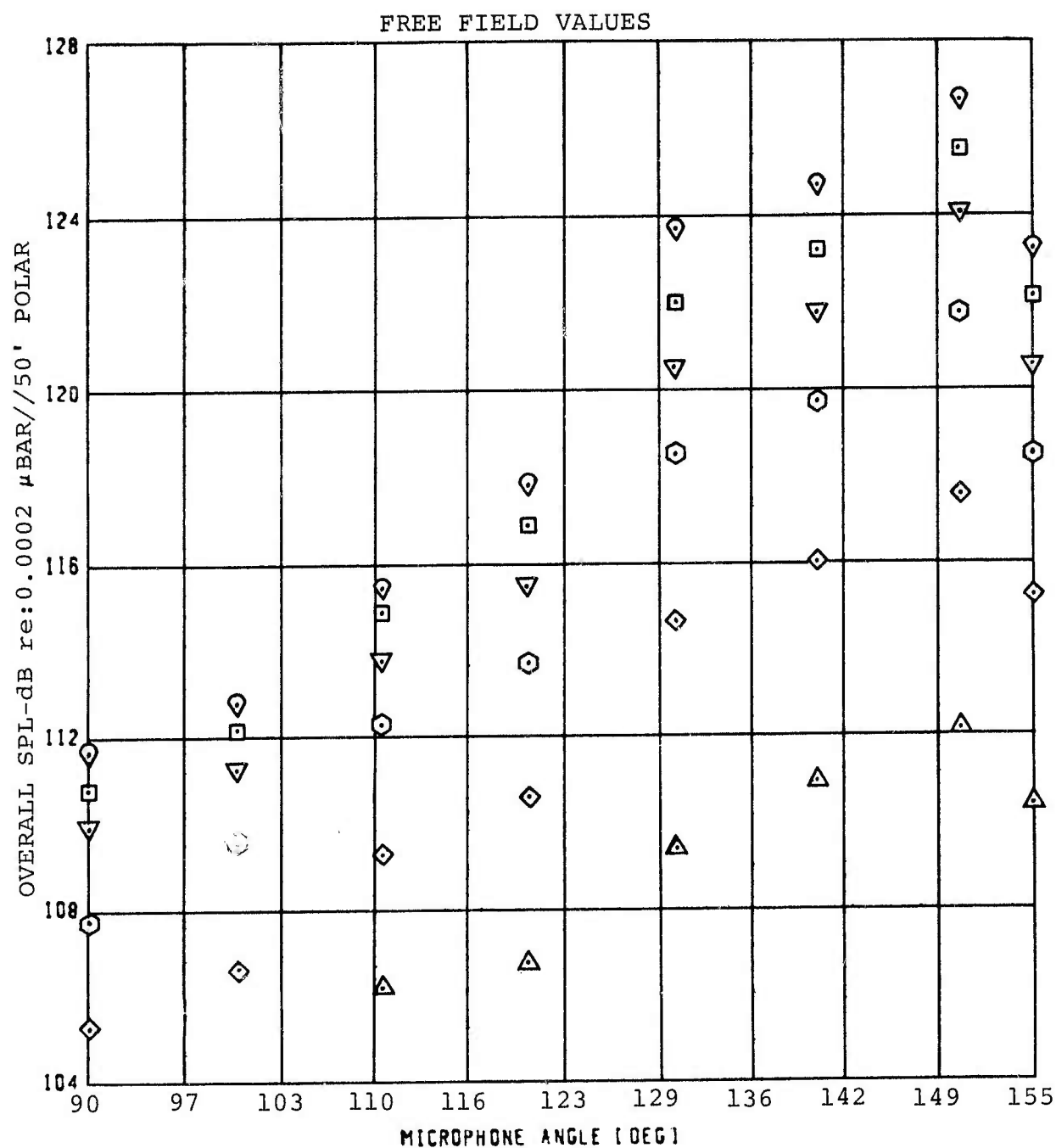
MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [O9]
○	189C	1150°F	2.000	130°	50FP	115.3
□	189C	1150	2.500	↓	50FP	120.5
x	189C	1150	3.000	↓	50FP	124.4
*	189C	1150	3.400	↓	50FP	126.4
γ	189C	1150	3.700	↓	50FP	127.9
●	189C	1150	4.000	↓	50FP	129.6

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS



NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

OASPL BEAM PATTERNS

SAE RC NOZZLE
 $A_8 = 12.6 \text{ FT}^2$

AVERAGE RC NOZZLE

$1/2$ T/ANNULUS-3.3AR-CPA-ET/RC (0.383" WIDE ANNULUS)

1000' ALTITUDE

20° ENGINE ATTITUDE

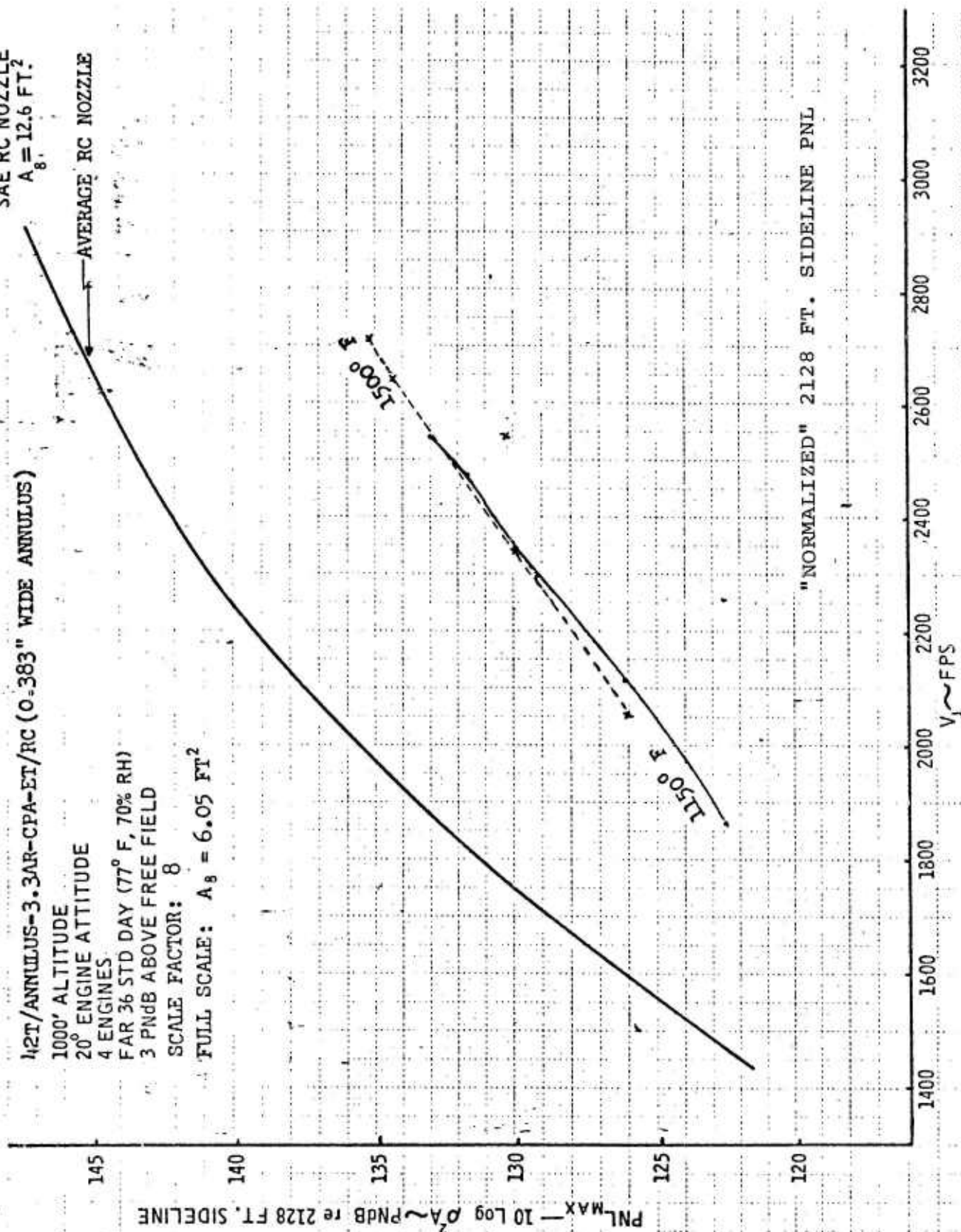
4 ENGINES

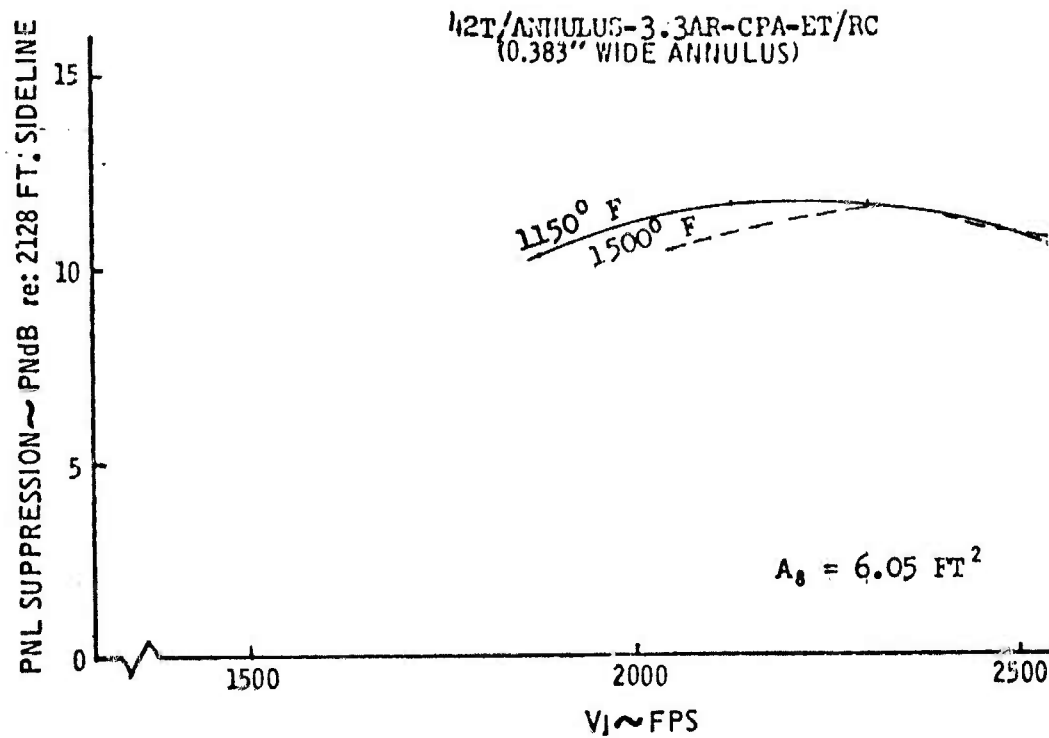
FAR 36 STD DAY (77° F, 70% RH)

3 PNdB ABOVE FREE FIELD

SCALE FACTOR: 8

FULL SCALE: $A_8 = 6.05 \text{ FT}^2$



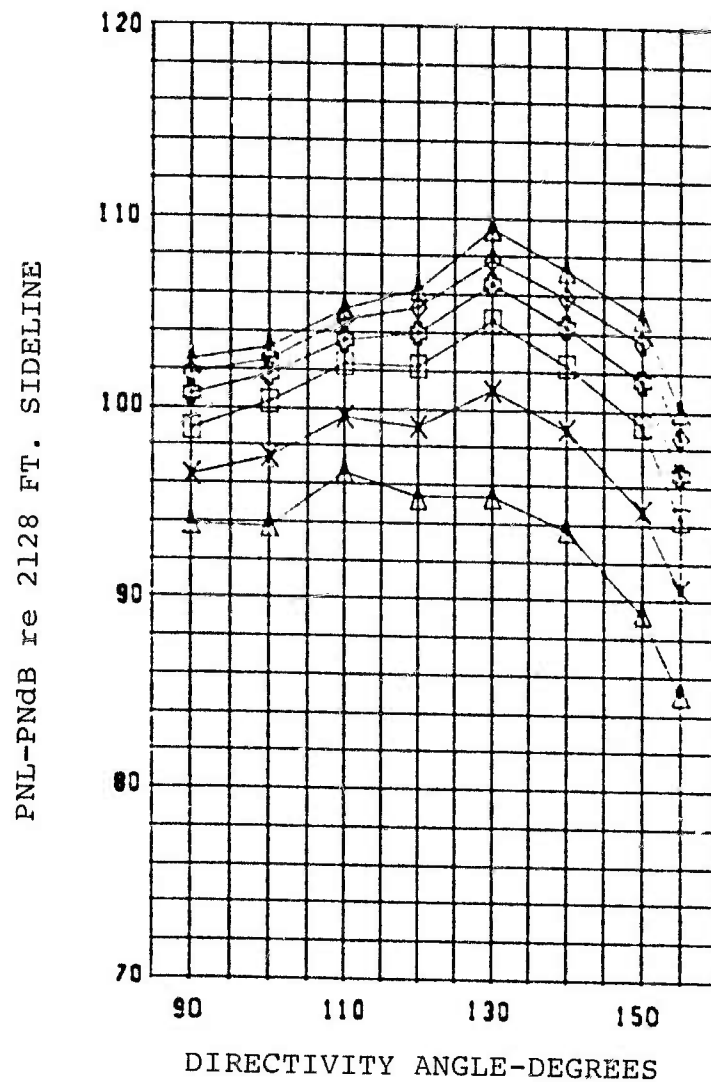


PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = TEMP = 77 DEG R.H. = 70 PER CENT

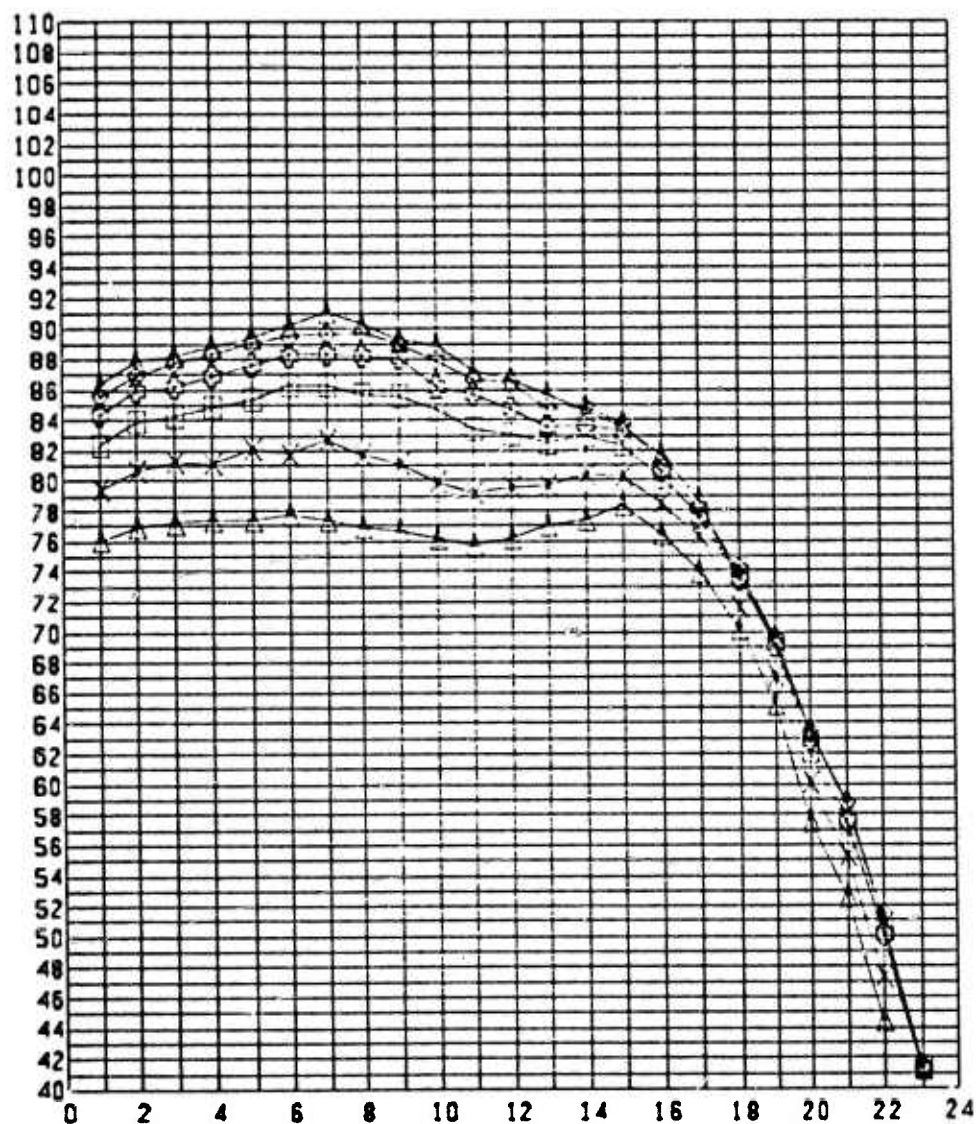


Tt = 1150°F A8 = 6.05 FT² RUN: 189
PR = △ 2.0, × 2.5, □ 3.0, + 3.4, ◇ 3.7, ▲ 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



1/3 OCTAVE BANDS. BAND NUMBERS BEGIN AT 50 HZ.
 TT = 1150°F A8 = 6.05 FT² RUN: 189
 PR = ▲ 2.0, ✕ 2.5, □ 3.0, + 3.4, ◆ 3.7, ▲ 4.0

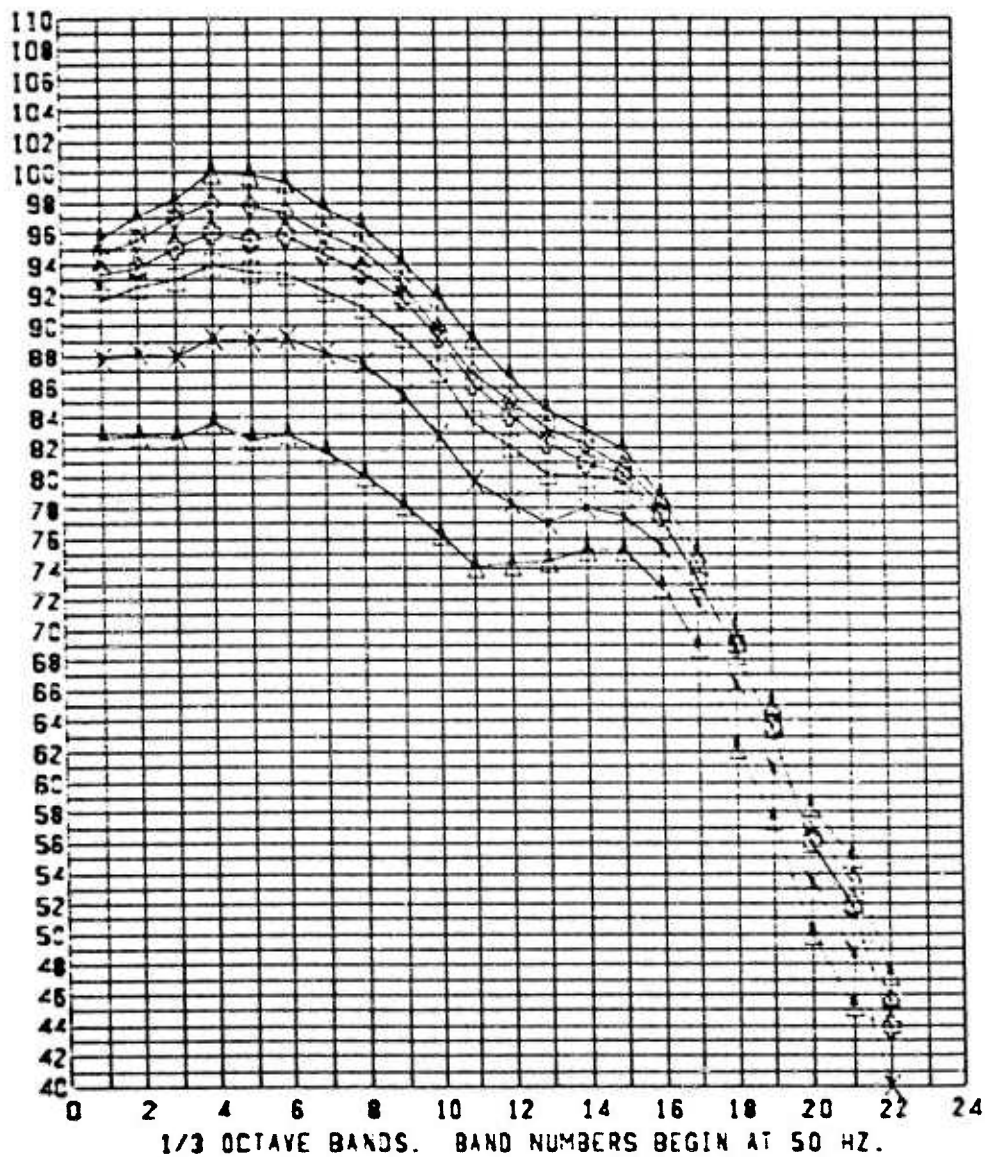
NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
 (0.383" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR/2128 FT SIDELINE



Tt = 1150°F A8 = 6.05 FT² RUN: 189
PR = Δ 2.0, X 2.5, \square 3.0, + 3.4, \diamond 3.7, \blacktriangle 4.0

NOZZLE: 42T/ANNULUS-3.3AR-CPA-ET/RC
(0.383" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/ANNULUS-3.3AR-ET/RC
(0.383" WIDE ANNULUS AND CENTER BODY)

FACILITY: WALL ISOLATION FACILITY

DATE: December 21, 1973

P_{AMB} = 29.62 in Hg **T_{AMB}** = 45°F **R.H.** = 86%

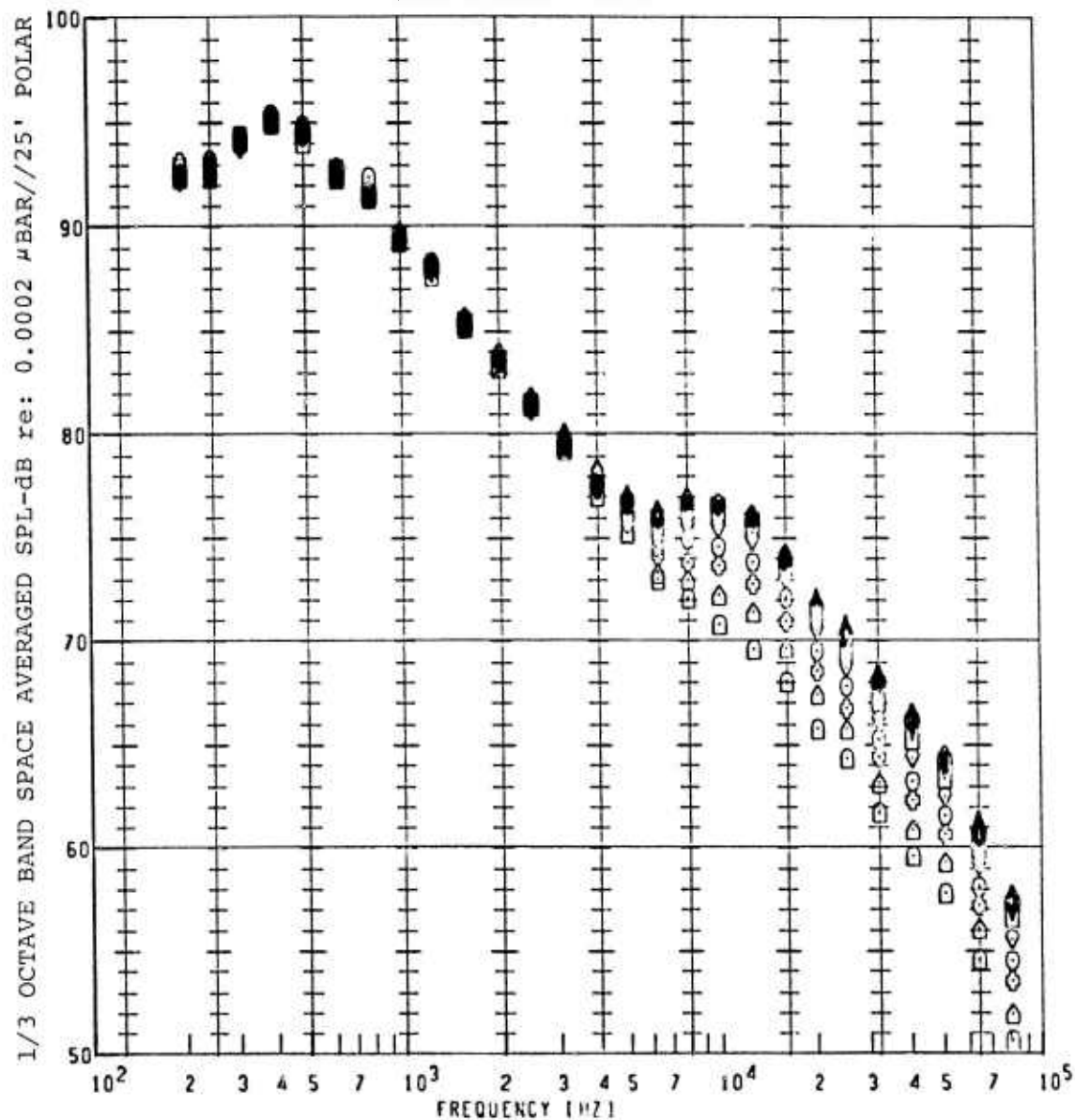
NPR = 3.0 **T_T** = 1150°F **V_J(IDEAL)** = 2300 FPS

SCALE MODEL A₈ = 13.6 in.²

<u>RUN NO.</u>	<u>AXIAL LOCATION</u>	<u>IRIS DIA.</u>	<u>REMARKS</u>	<u>REF.</u>
251	0.0 x/D	9.4 in.		
254	0.25	9.6		
257	0.50	9.8		
260	0.75	10.0		
263	1.00	10.4		
266	1.25	10.6		
269	1.50	10.8		
272	1.75	11.2		
275	2.0	11.6		
278	2.5	12.0		
281	3.0	12.4		
284	3.5	13.2		
287	4.0	13.6		
290	5.0	14.4		
293	6.0	15.6		
296	7.0	16.4		
299	8.0	17.8		
302	10.0	19.8		
305	12.0	22.0		
308	14.0	24.0		

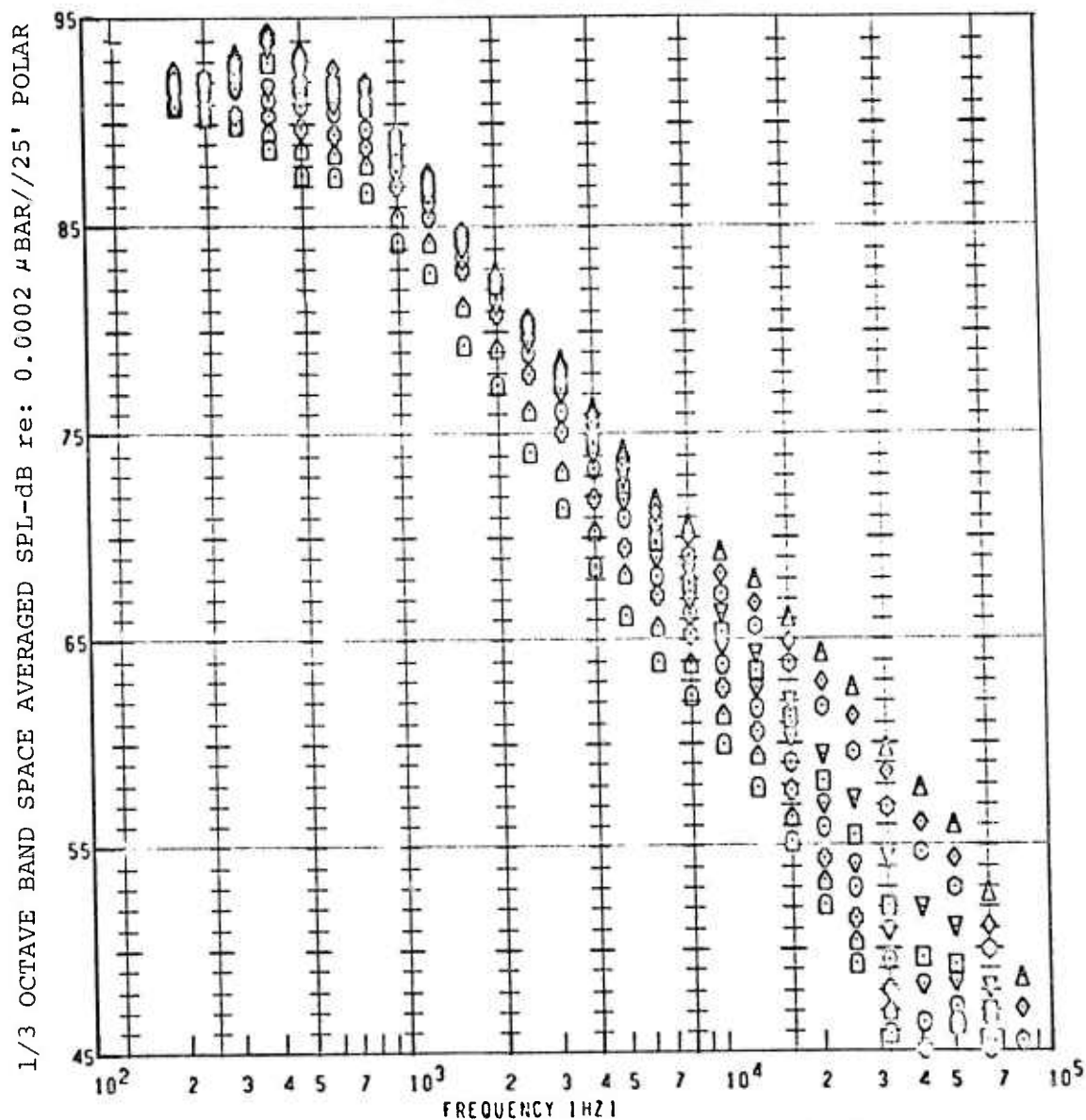
MICROPHONE LAYOUT: 25 FOOT VERTICAL POLAR ARC

FREE FIELD VALUES

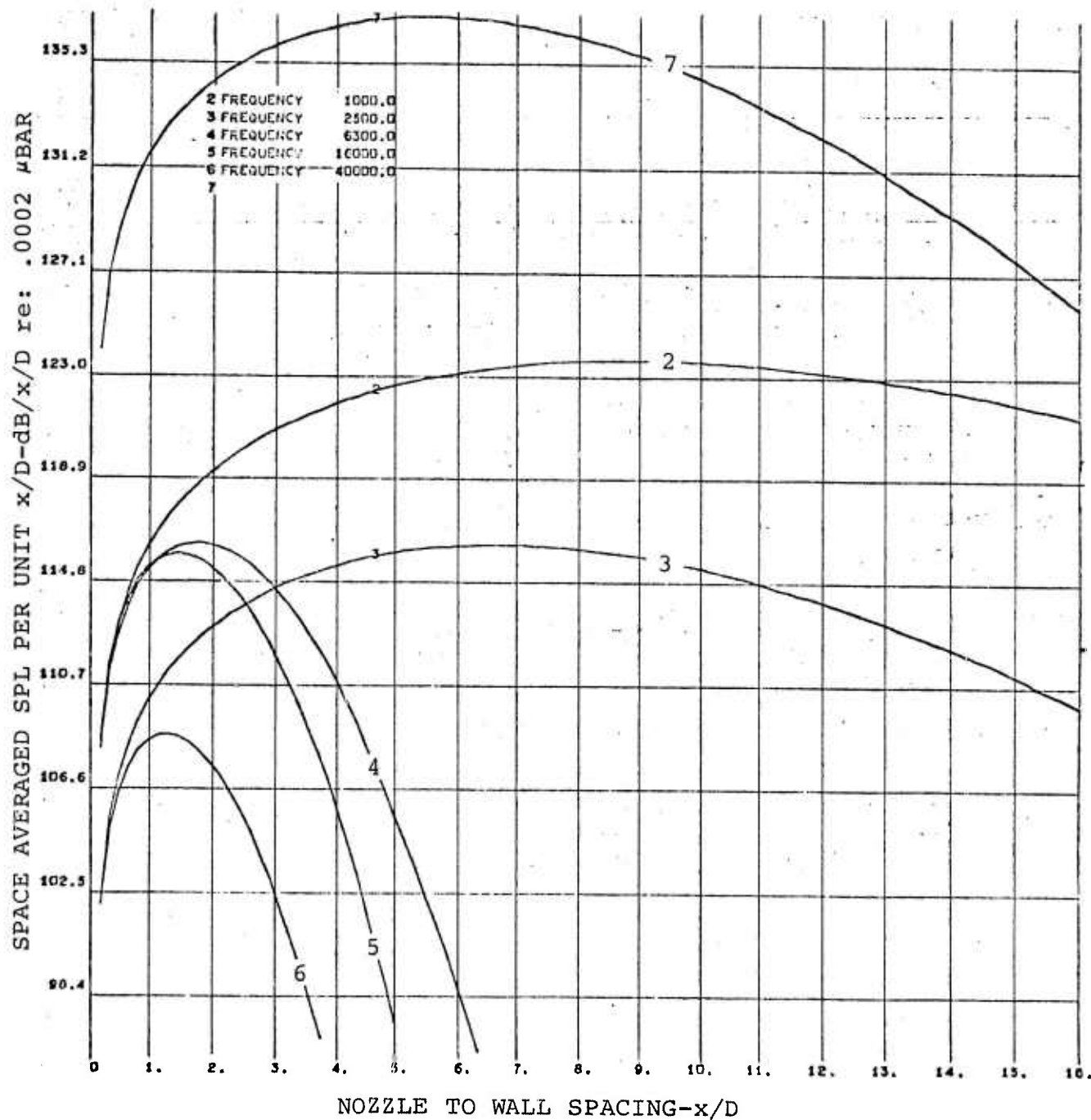


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP	AXIAL LOCATION, x/D
▲	251	3.00	1150°F	0
◇	254	3.00	1150	.25
○	257	3.00	1150	.50
▽	260	3.00	1150	.75
□	263	3.00	1150	1.0
◊	266	3.00	1150	1.2
⊙	269	3.00	1150	1.5
⊗	272	3.00	1150	1.7
△	275	3.00	1150	2.0
◻	278	3.00	1150	2.5

FREE FIELD VALUES



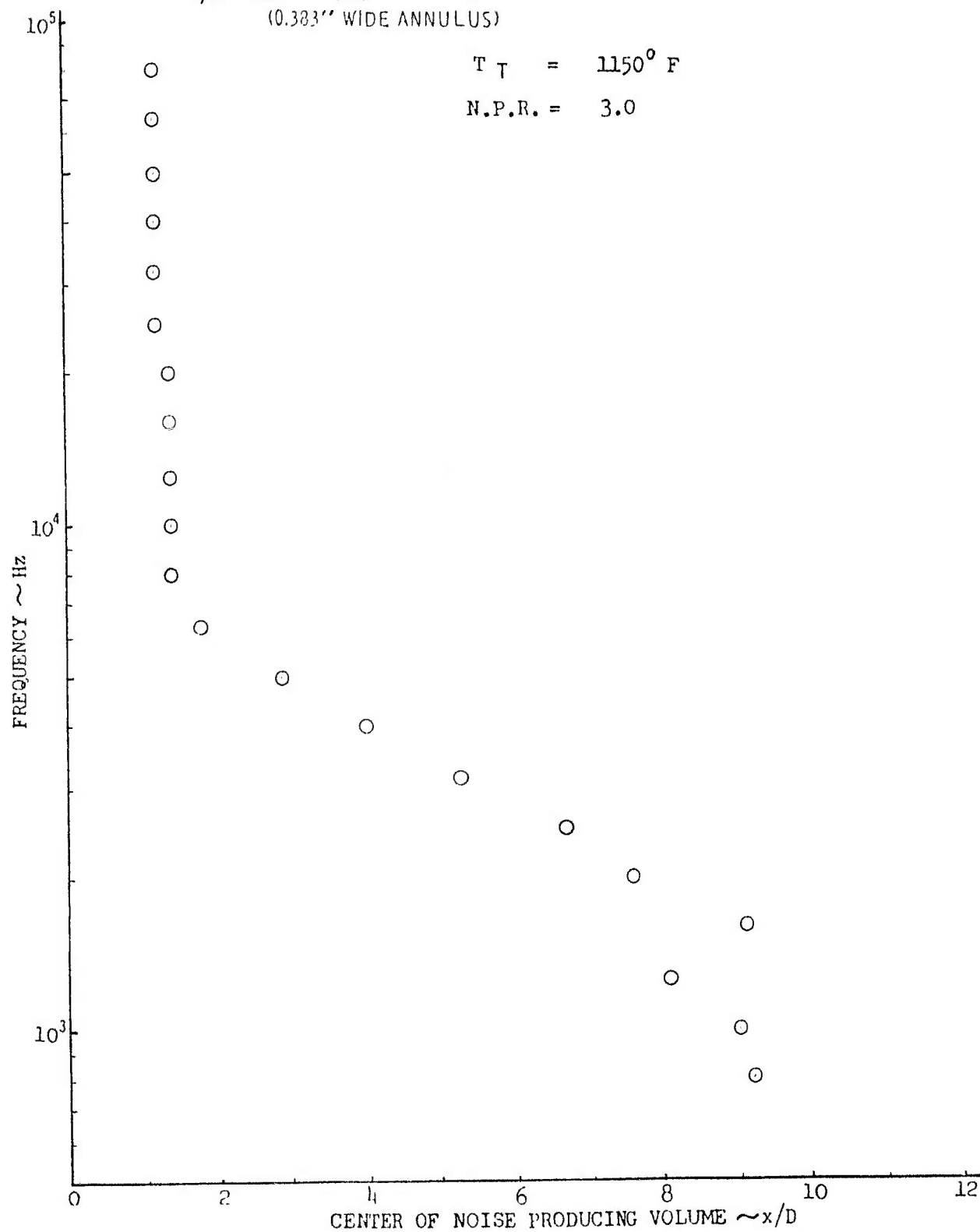
PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP	AXIAL LOCATION, x/D
△	281	3.00	1150°F	3.0
◇	284	3.00	1150	3.5
○	287	3.00	1150	4.0
▽	290	3.00	1150	5.0
□	293	3.00	1150	6.0
×	296	3.00	1150	7.0
+	299	3.00	1150	8.0
*	302	3.00	1150	10.0
○	305	3.00	1150	12.0
○	308	3.00	1150	14

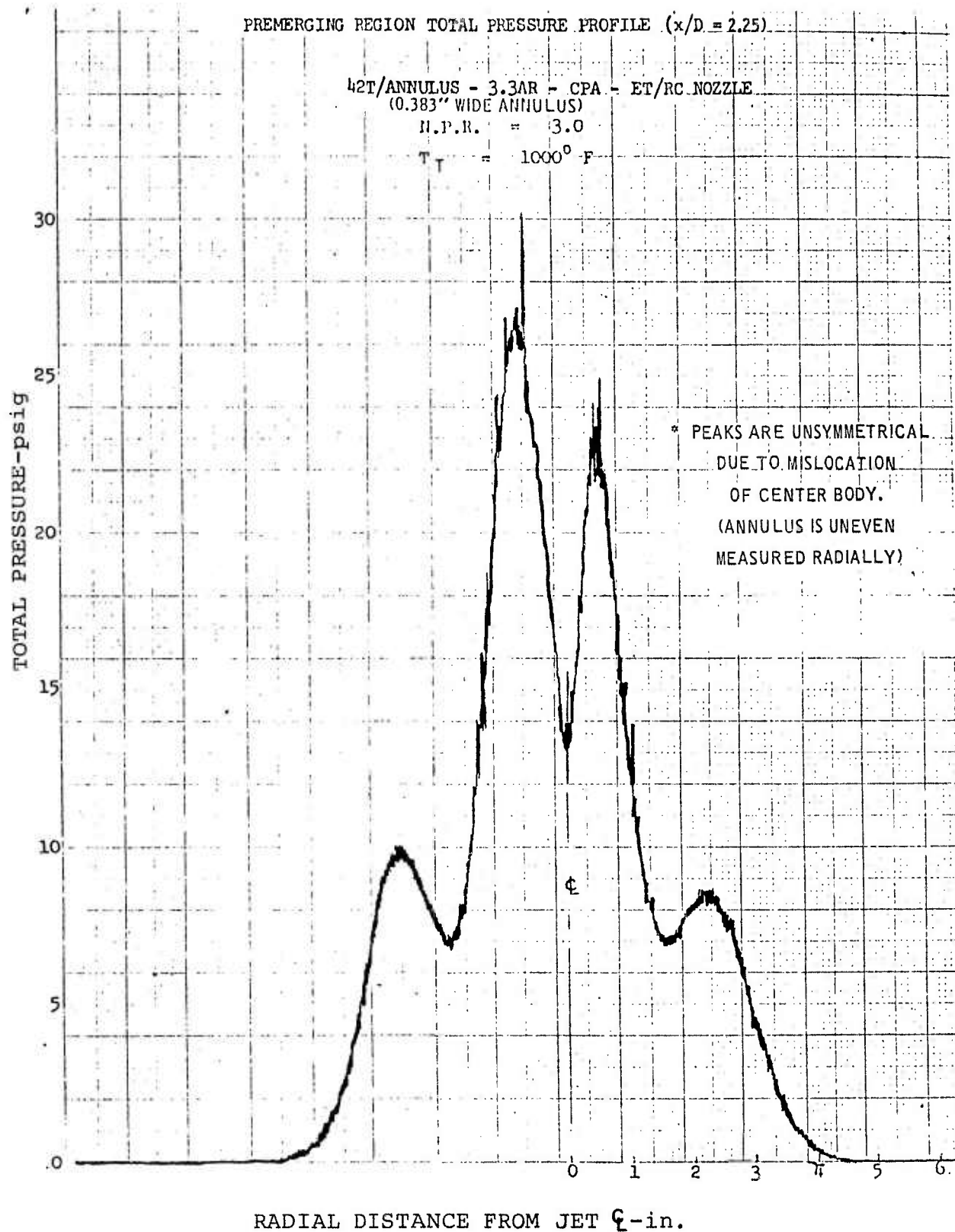


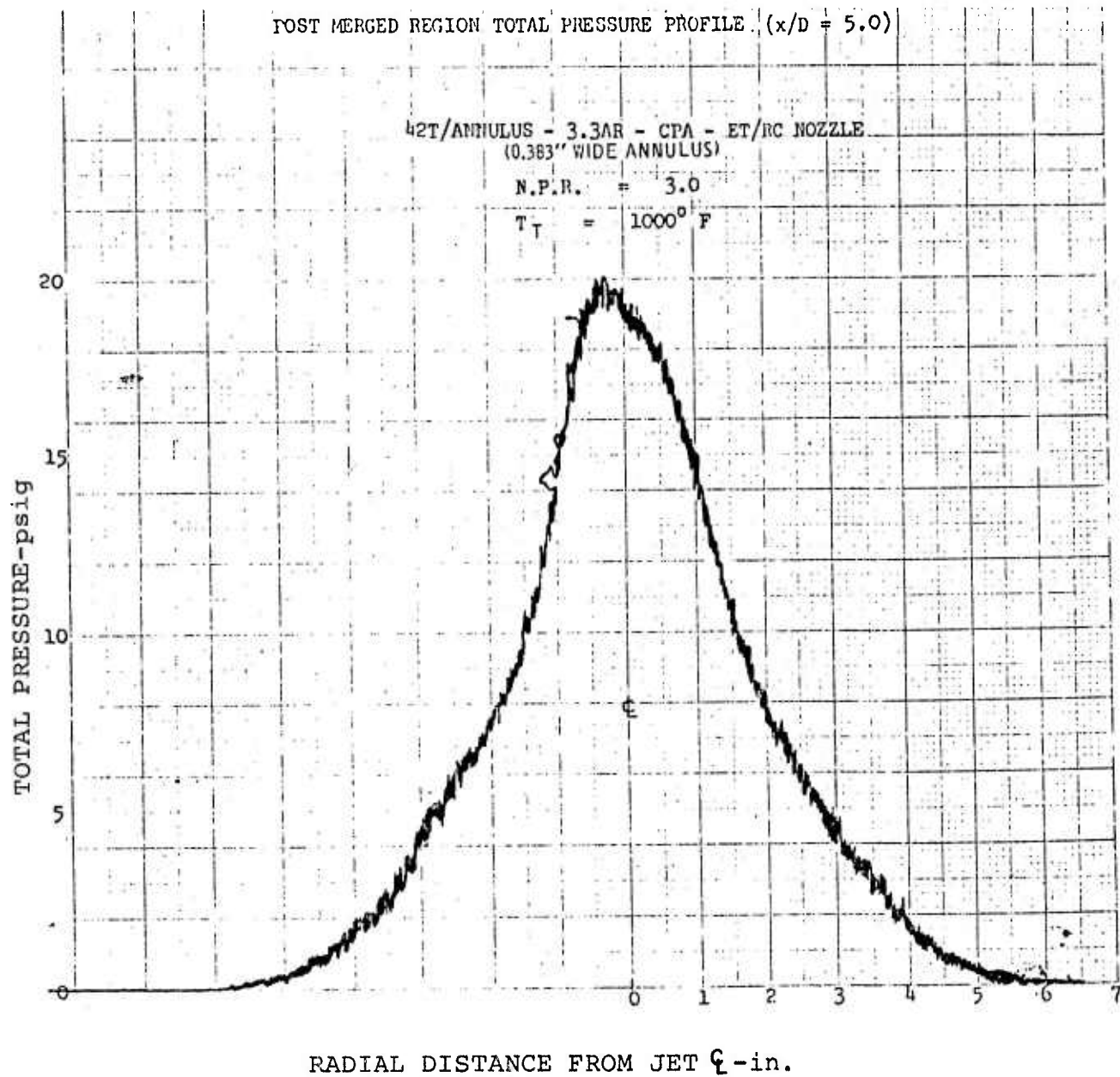
42T/ANNULUS - 3.3AR -ET/RC NOZZLE
(0.383" WIDE ANNULUS)

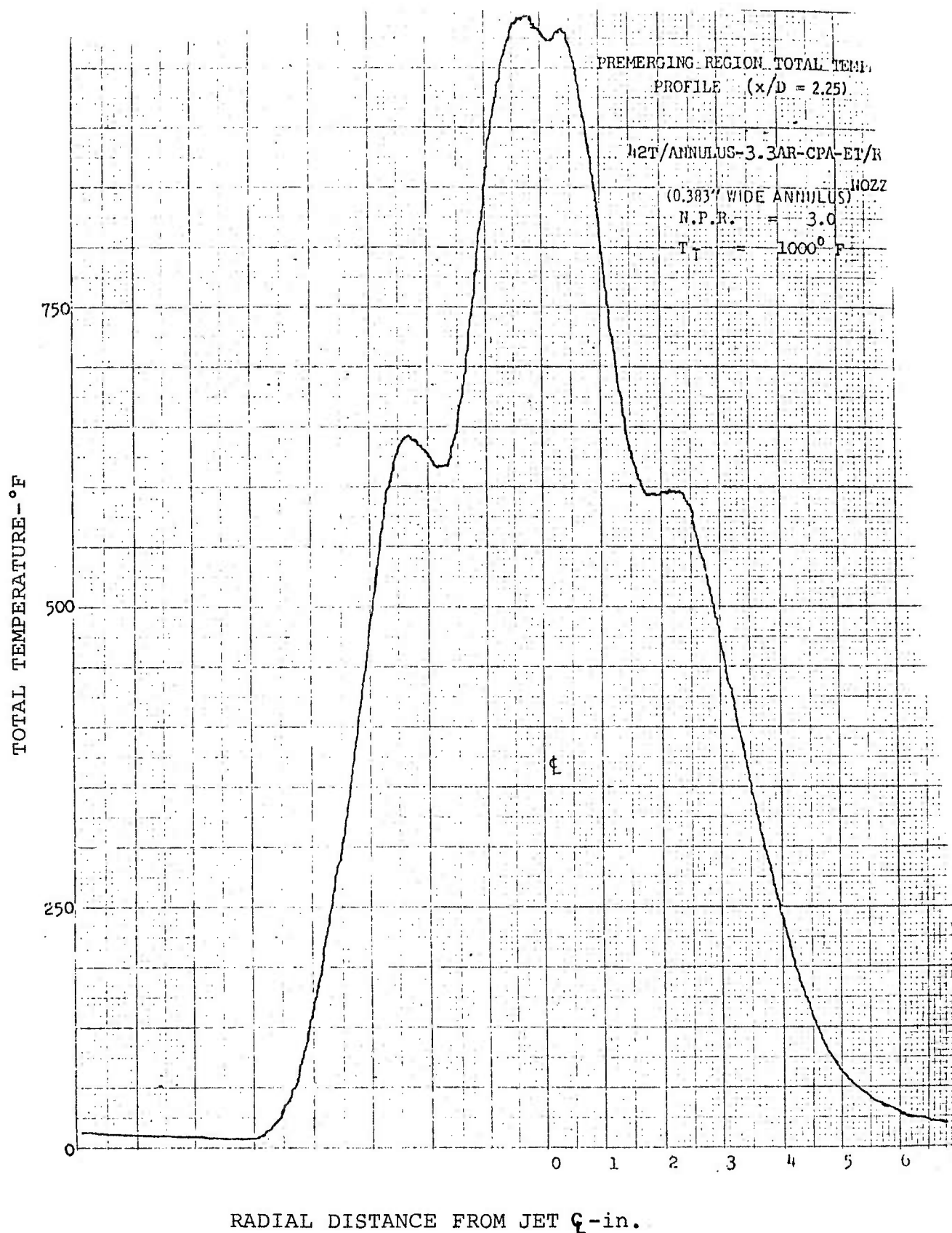
$T_T = 1150^\circ \text{ F}$

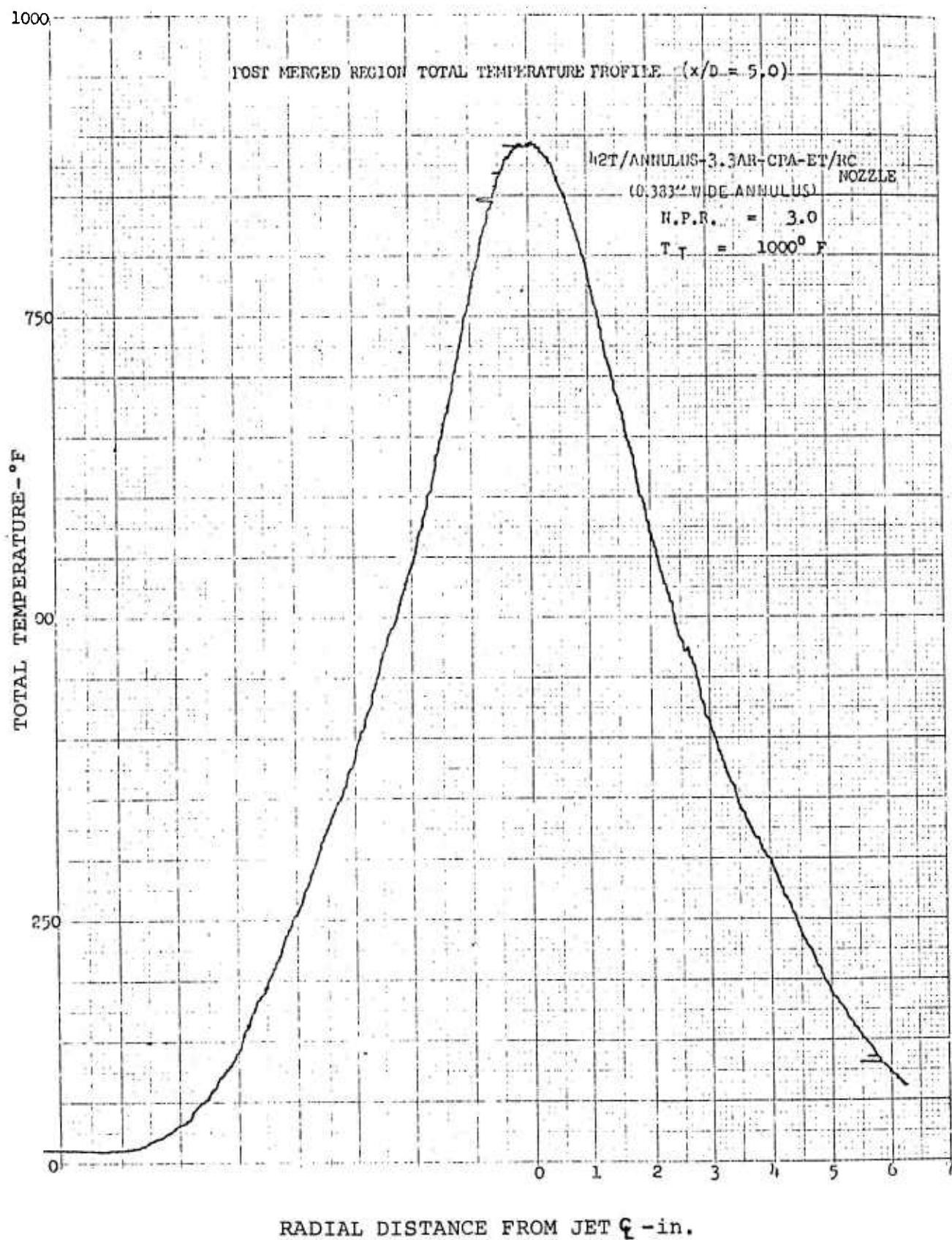
N.P.R. = 3.0

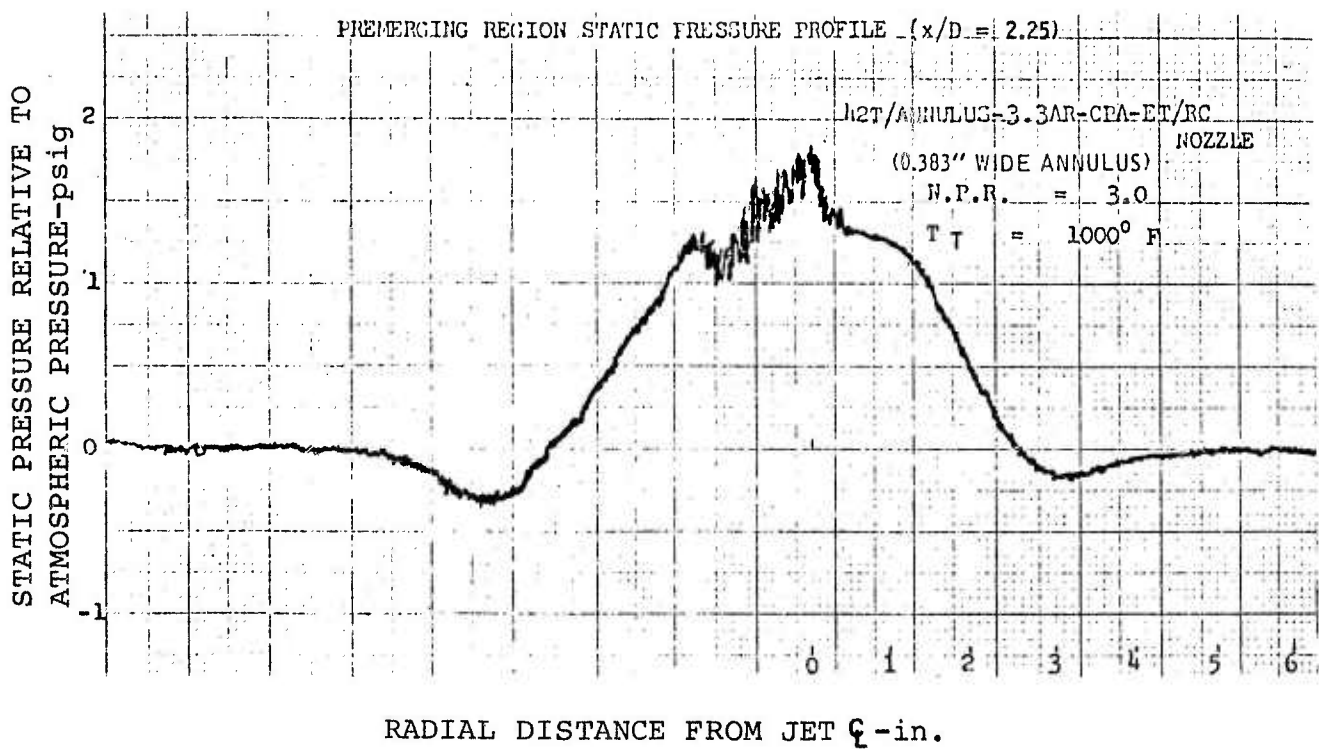


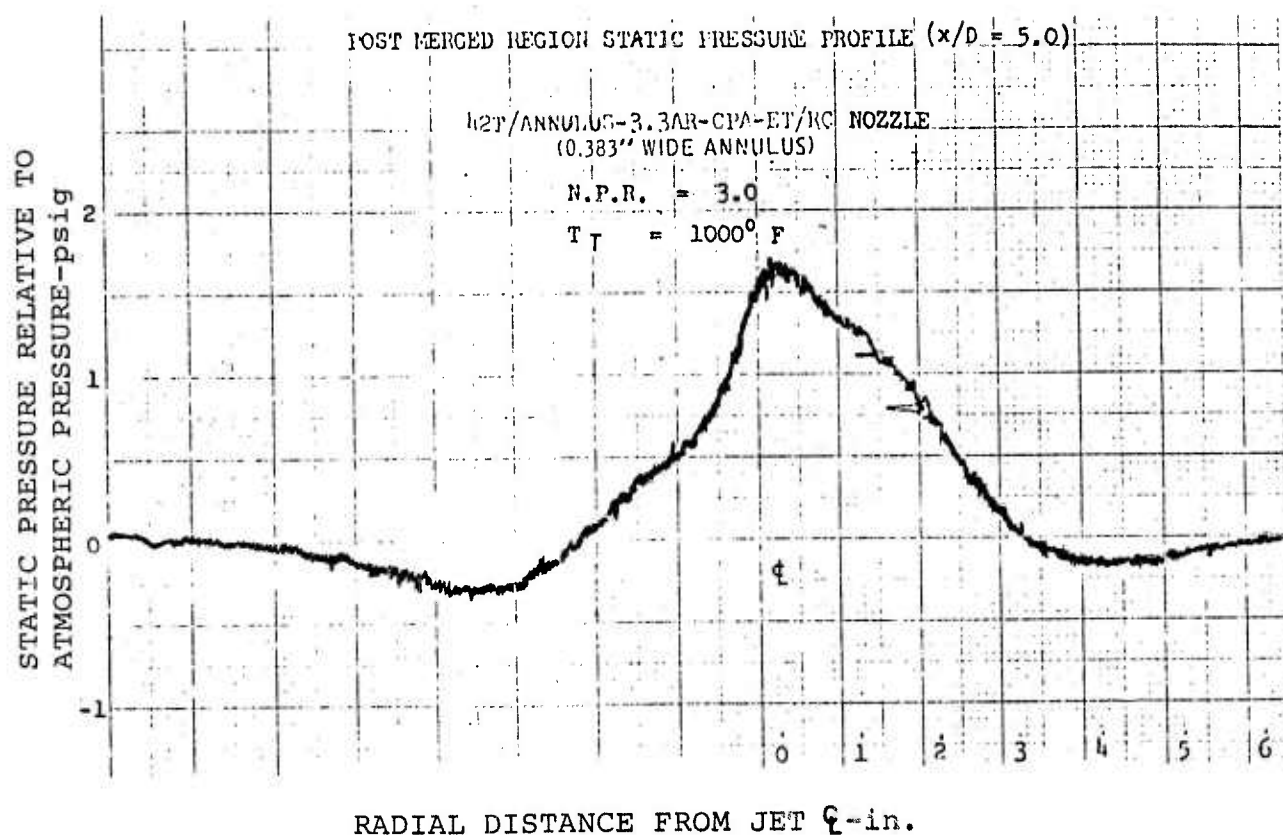












TEST CONDITIONS

NOZZLE: 42T/Annulus-3.0AR-CPA-ET/RC

FACILITY: HNTF

DATE: 10-17-73

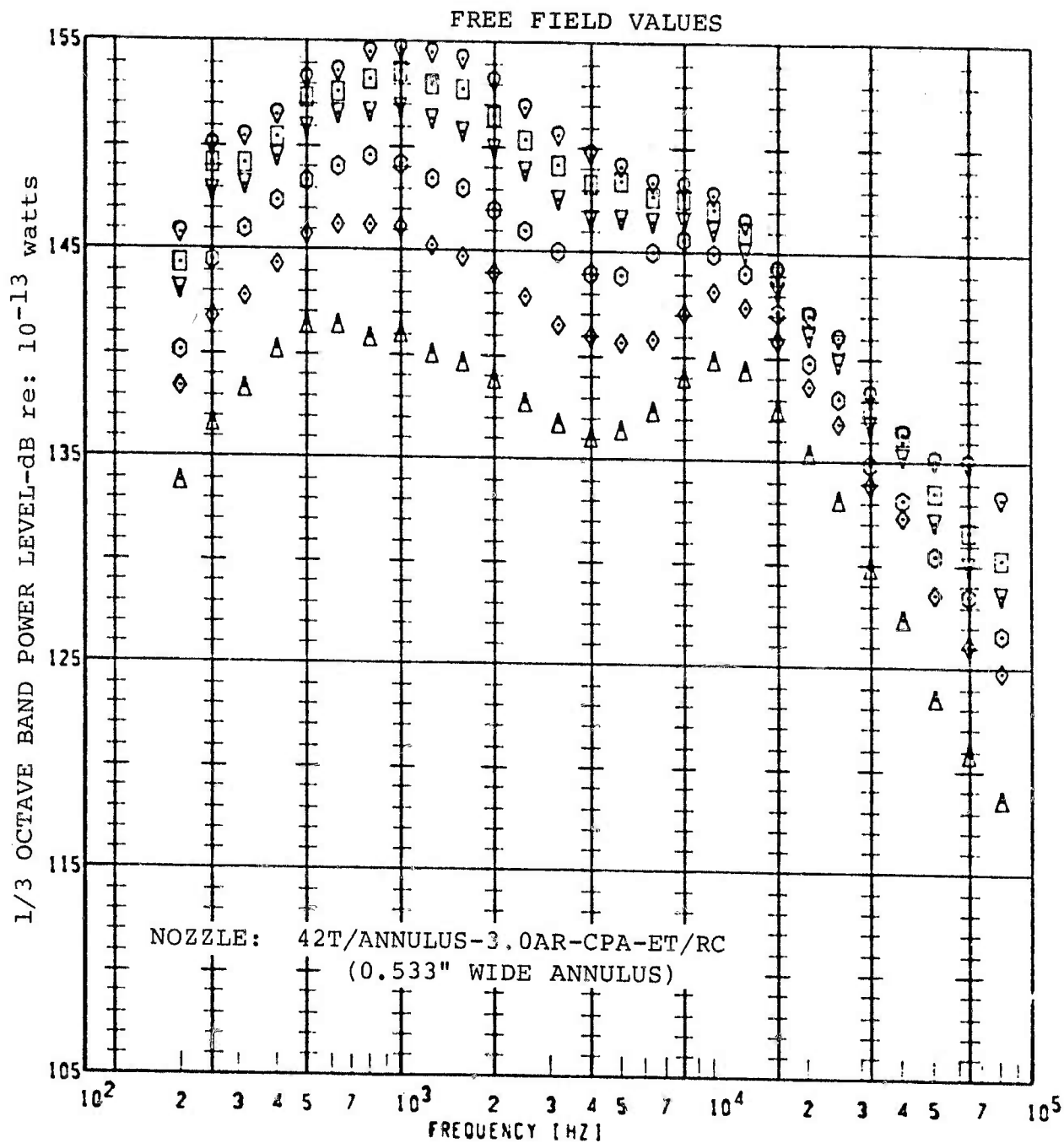
T_{AMB} = 70°F

R.H. = 52°

SCALE MODEL $A_8 = 15.0 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
177	2.0	1150°F	1875 fps	Annulus width =	
"	2.5	"	2126	0.533"	
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

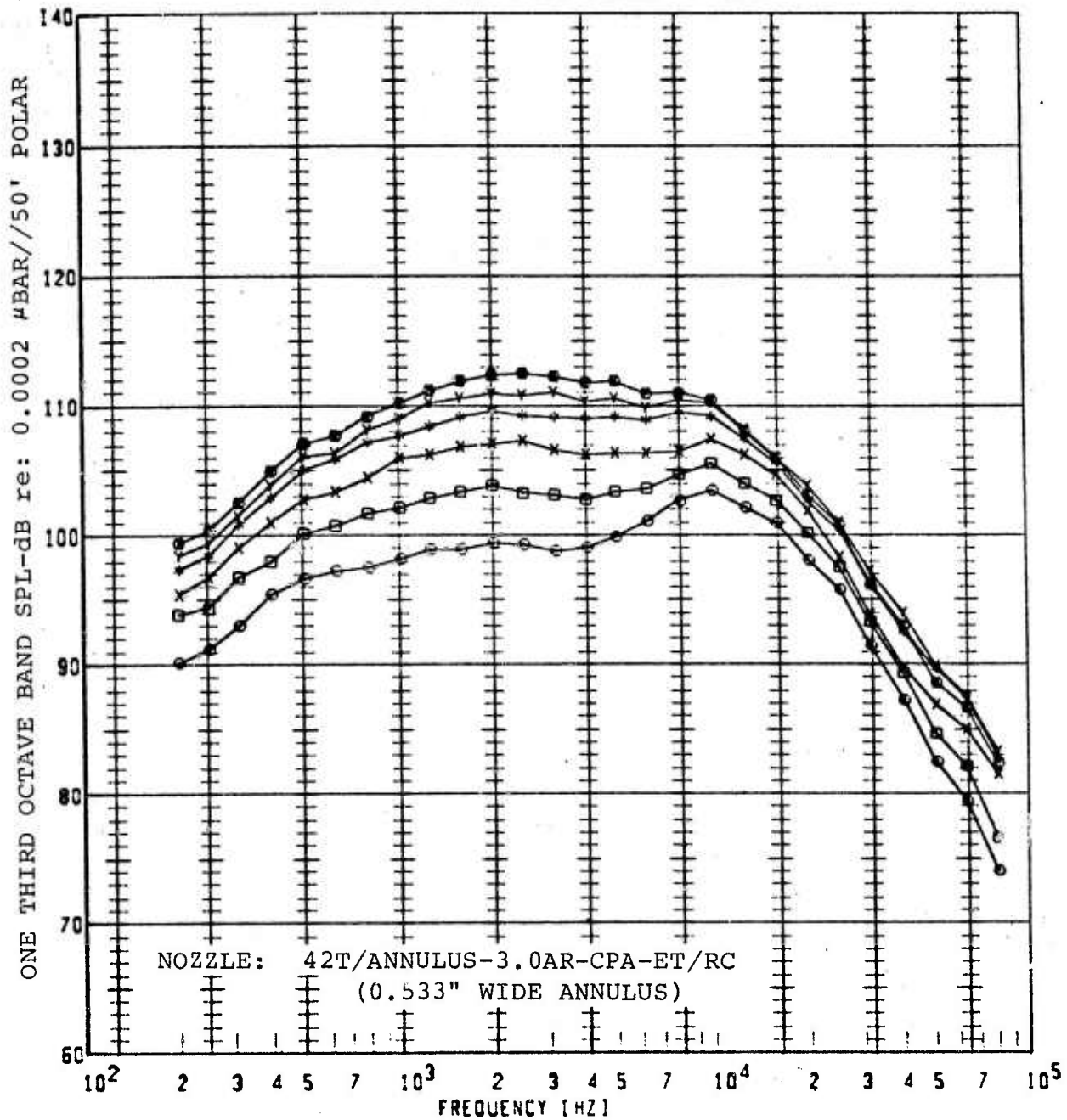
MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	177	2.00	1150°F
◇	177	2.50	1150
○	177	3.00	1150
▽	177	3.43	1150
□	177	3.70	1150
⊙	177	4.00	1150

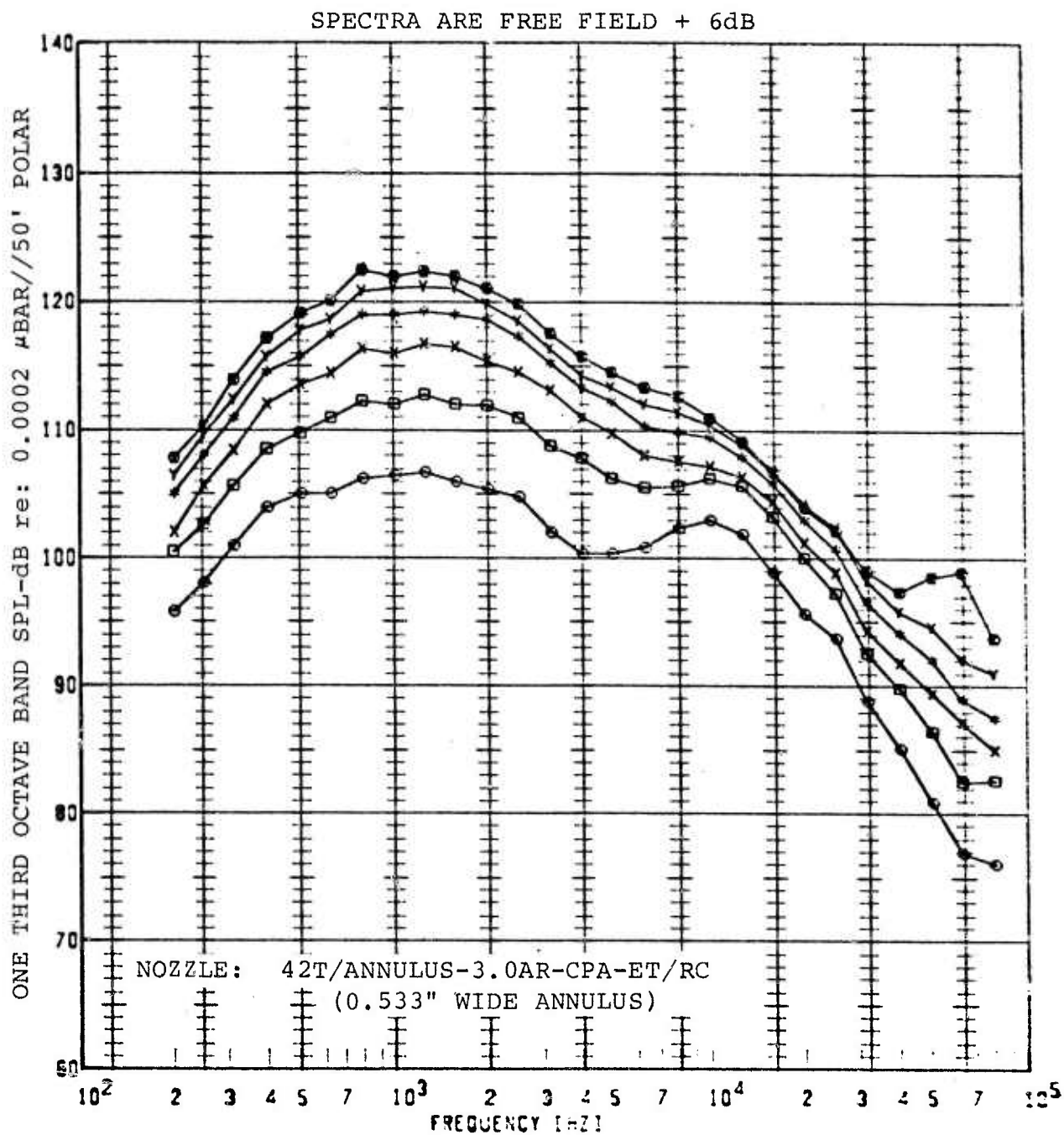
JET NOISE POWER SPECTRA

SPECTRA ARE FREE FIELD + 6dB



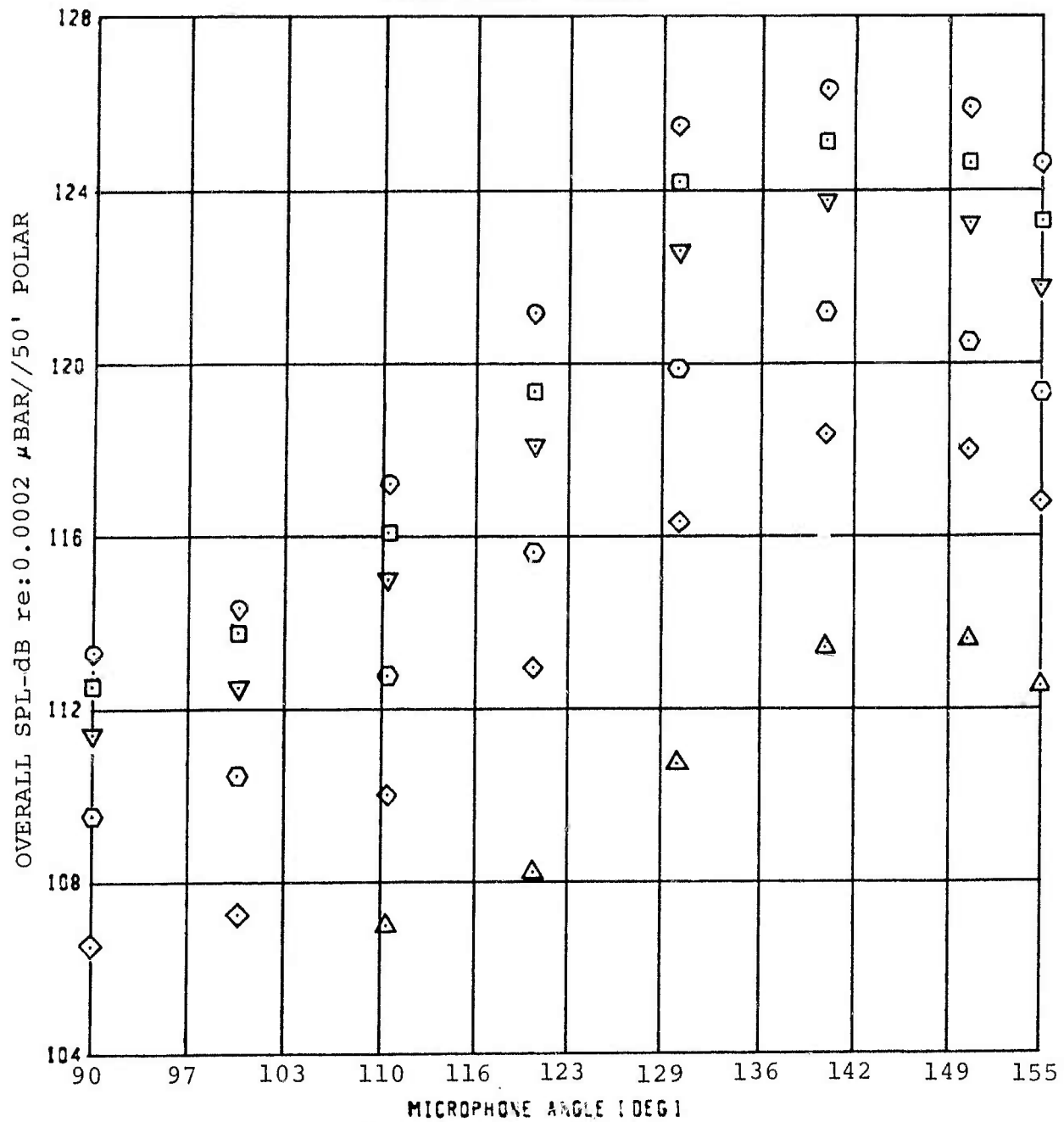
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	CASPL (DB)
○	177G	1150°F	2.000	110°	50FP	112.6
□	177G	1150	2.500		50FP	115.7
x	177G	1150	3.000		50FP	118.5
*	177G	1150	3.400		50FP	120.7
y	177G	1150	3.700		50FP	121.9
●	177G	1150	4.000		50FP	123.0

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS



MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

FREE FIELD VALUES



PLCT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	177	2.00	1150°F
◇	177	2.50	1150
⊙	177	3.00	1150
▽	177	3.40	1150
⊠	177	3.70	1150
⊙	177	4.00	1150

NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
(0.533" WIDE ANNULUS)

OASPL BEAM PATTERNS

SAE RC NOZZLE
 $A_8 = 12.6 \text{ FT}^2$

AVERAGE RC NOZZLE

42T/ANNULUS-3. OAR-CPA-ET/RC (0.533" WIDE ANNULUS)

1000' ALTITUDE

20° ENGINE ATTITUDE

4 ENGINES

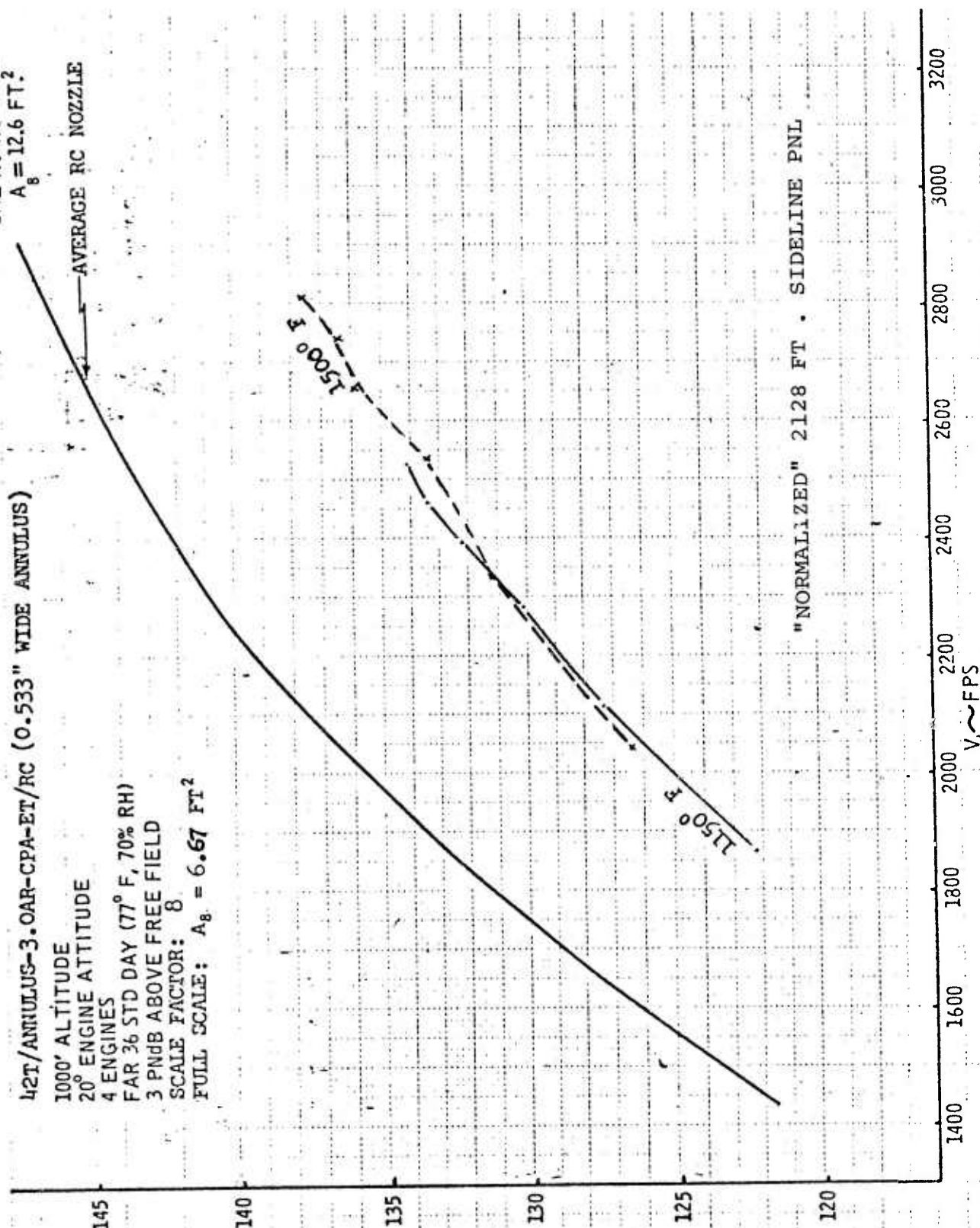
FAR 36 STD DAY (77° F, 70% RH)

3 PND B ABOVE FREE FIELD

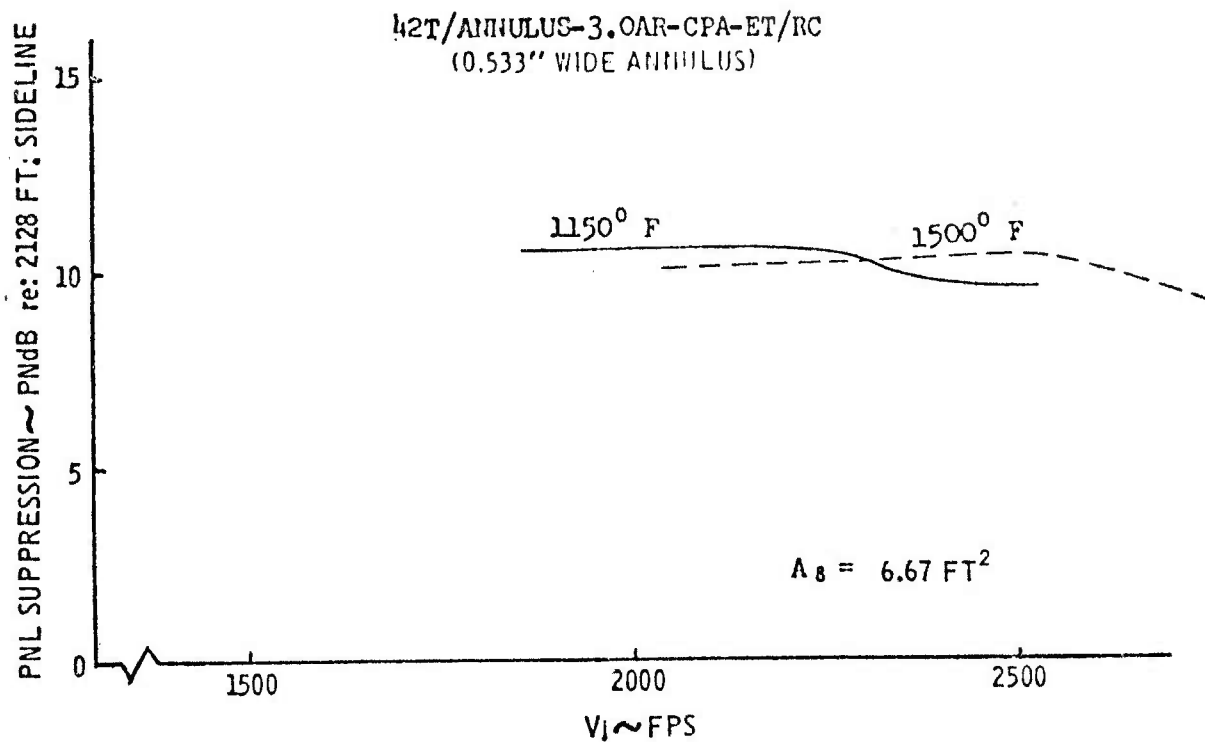
SCALE FACTOR: 8

FULL SCALE: $A_8 = 6.67 \text{ FT}^2$

$PNL_{MAX} - 10 \log \rho^2 A^2 \sim PND B$ re 2128 FT. SIDELINE

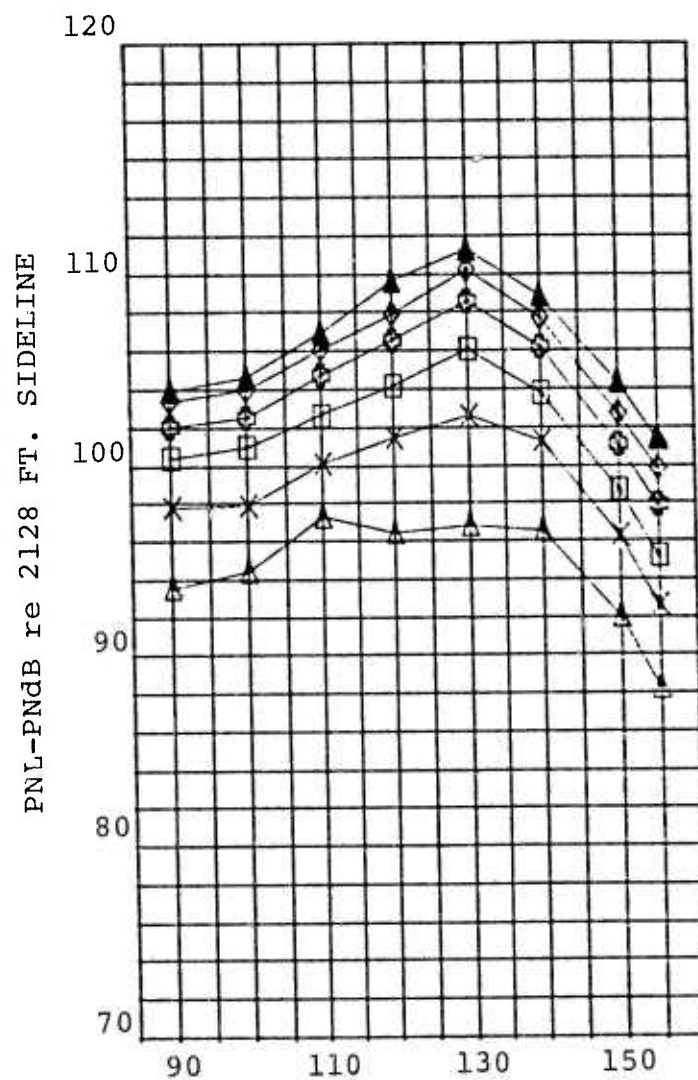


"NORMALIZED" 2128 FT. SIDELINE PNL



PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
(0.533" WIDE ANNULUS)



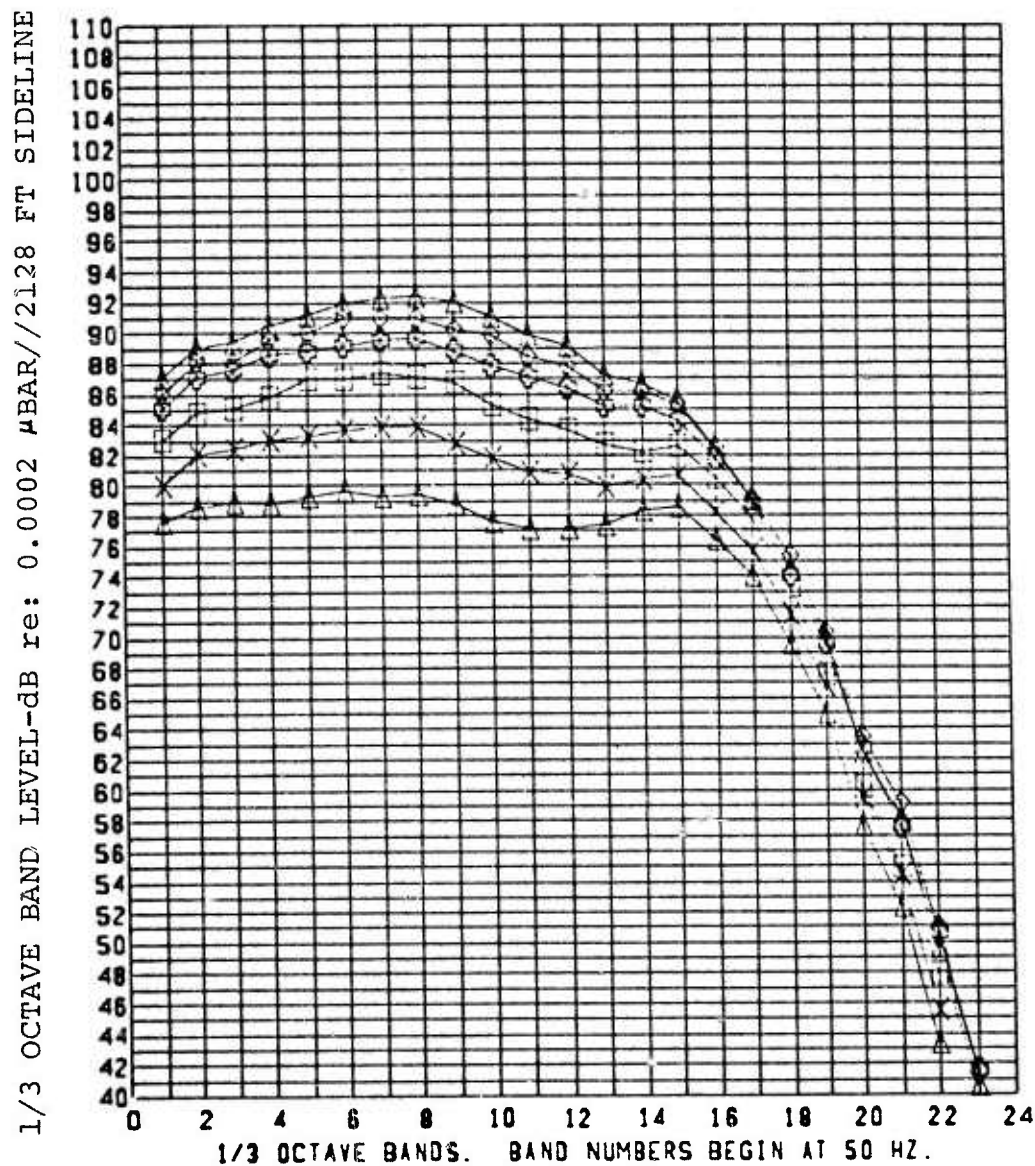
PR = △ 2.0, × 2.5, □ 3.0, + 3.4, ◇ 3.7, ▲ 4.0

TT = 1150°F A8 = 6.67 FT² RUN: 177

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



TT = 1150°F A8 = 6.67 FT² RUN: 177
 PR = ▲ 2.0, ✕ 2.5, □ 3.0, + 3.4, ◆ 3.7, ▲ 4.0

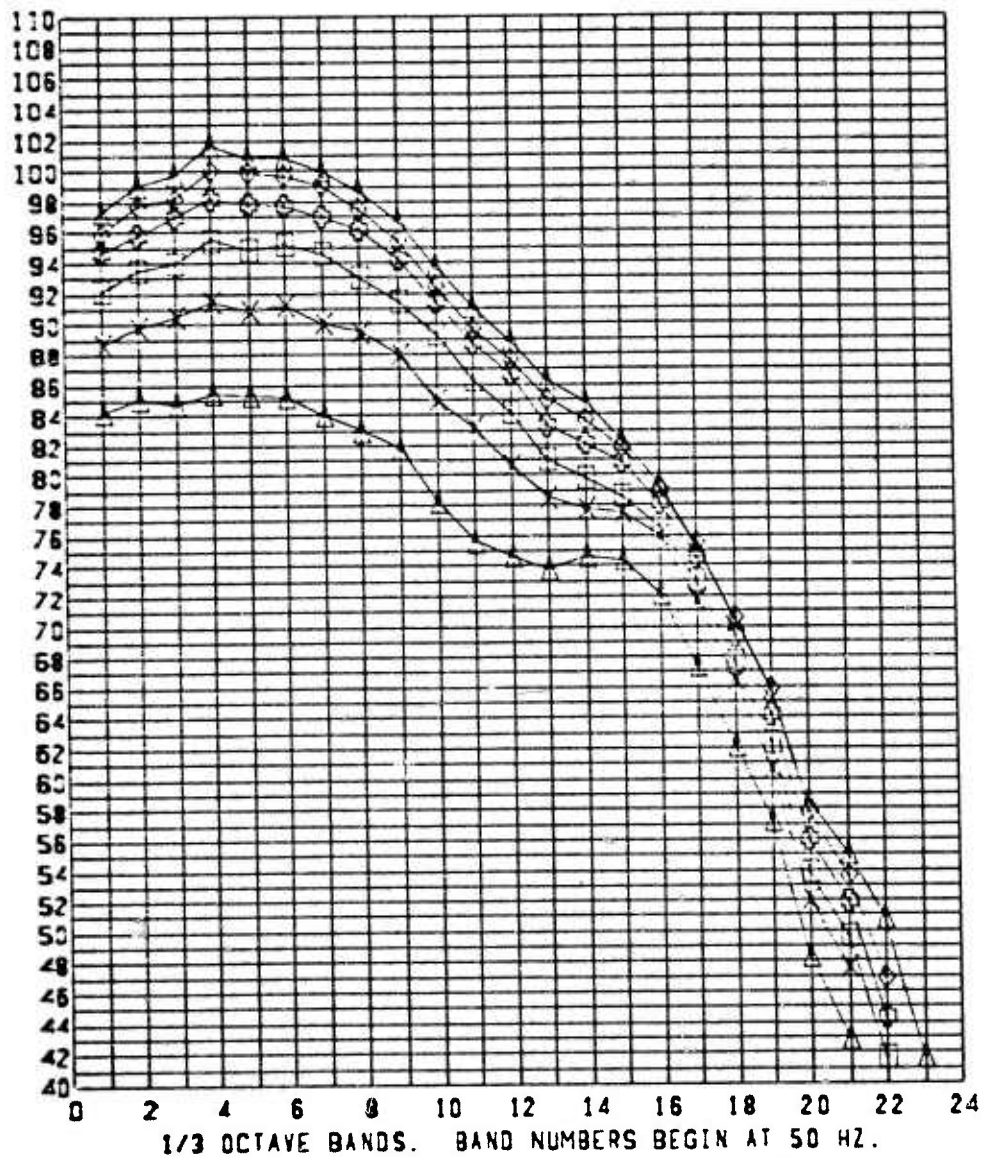
NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
 (0.533" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR/2128 FT SIDELINE



$T_t = 1150^\circ\text{F}$ $A_8 = 6.67 \text{ FT}^2$ RUN: 177

PR = Δ 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7, \blacktriangle 4.0

NOZZLE: 42T/ANNULUS-3.0AR-CPA-ET/RC
(0.533" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/Annulus-2.6AR-CPA-ET/RC

FACILITY: HNTF

DATE: 10-17-73

T_{AMB} = 55°F

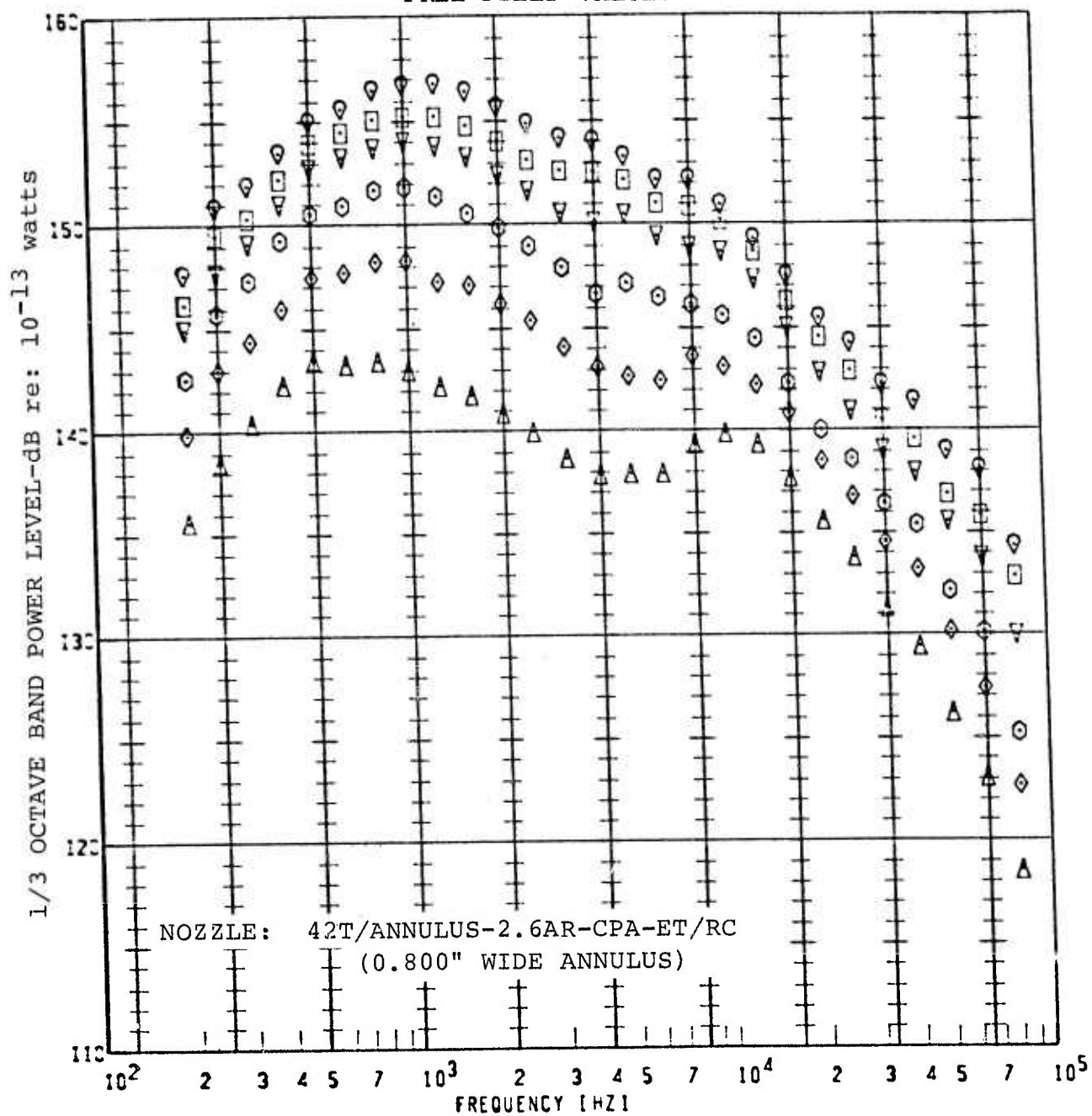
R.H. = 77%

SCALE MODEL A₈ = 17.2 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
175	2.0	1150°F	1875 fps	Annulus width =	
"	2.5	"	2126	0.8"	
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

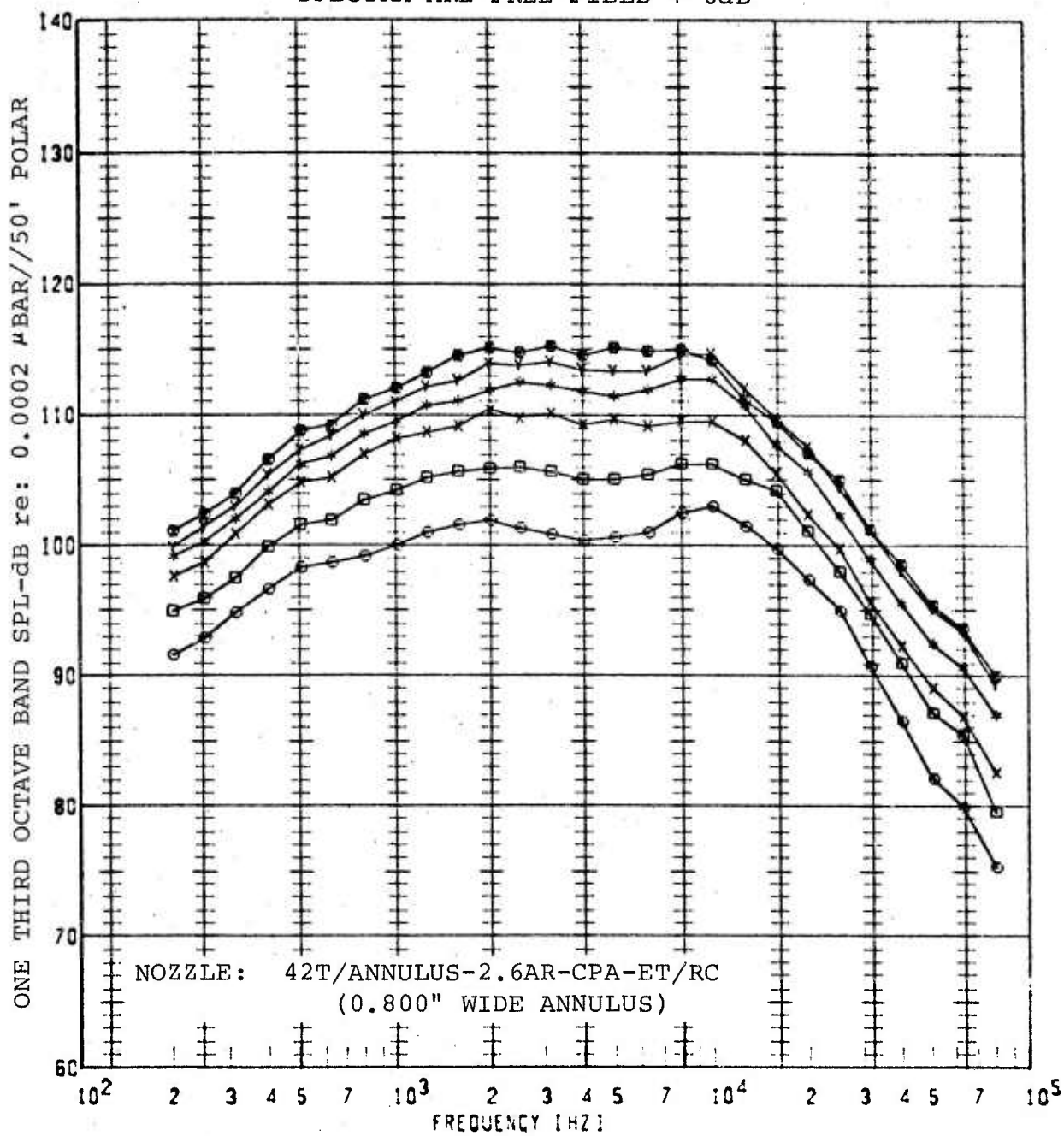
FREE FIELD VALUES



PLCT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	175	2.00	1150°F
◇	175	2.50	1150
○	175	3.00	1150
▽	175	3.40	1150
□	175	3.70	1150
◊	175	4.00	1150

JET NOISE POWER SPECTRA

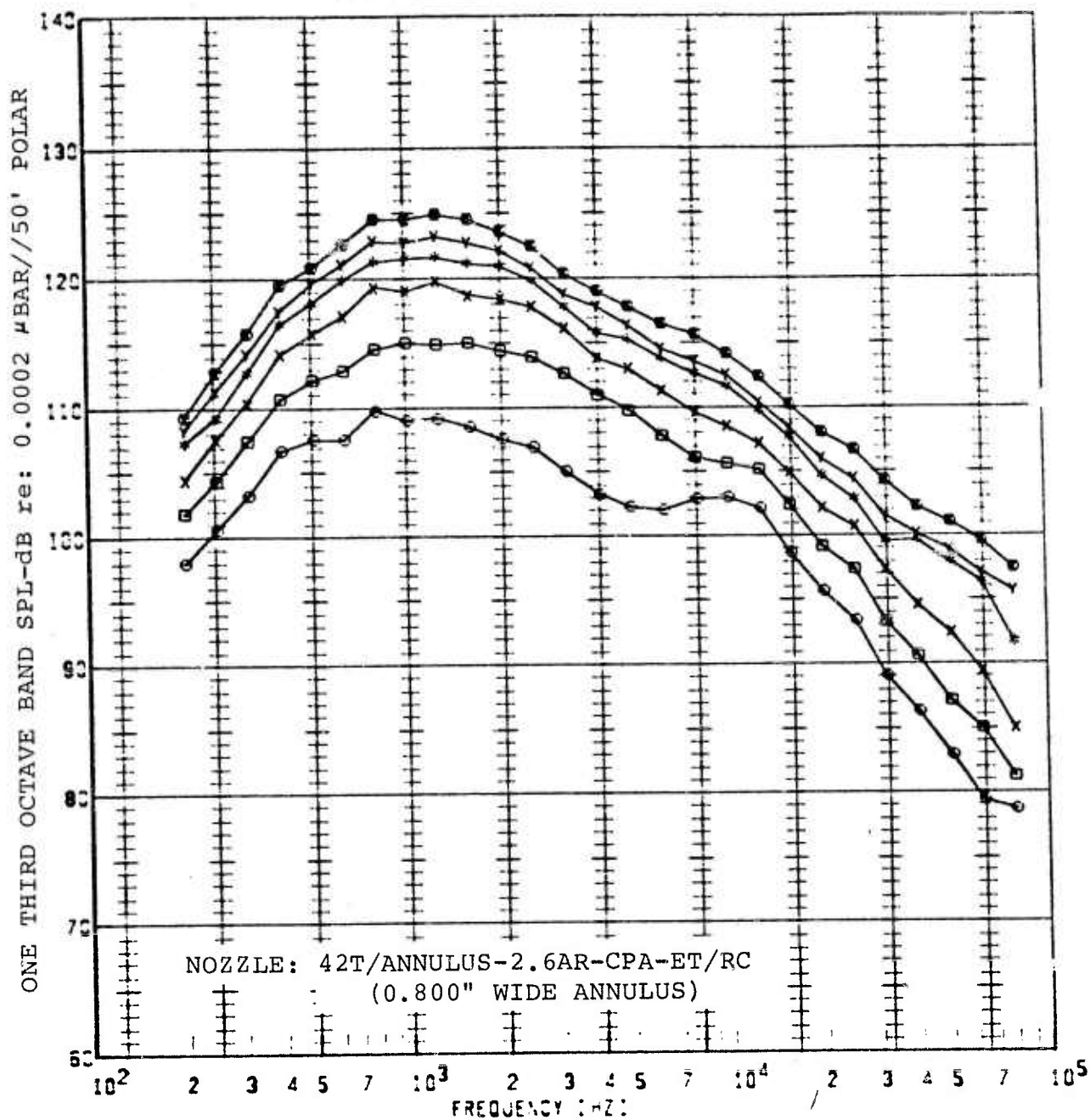
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OSPL [DB]
○	1756	1150°F	2.000	110°	50FP	113.4
□	1756	1150	2.500	↓	50FP	117.4
x	1756	1150	3.000	↓	50FP	121.0
*	1756	1150	3.400	↓	50FP	123.3
y	1756	1150	3.700	↓	50FP	124.9
●	1756	1150	4.000	↓	50FP	125.8

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

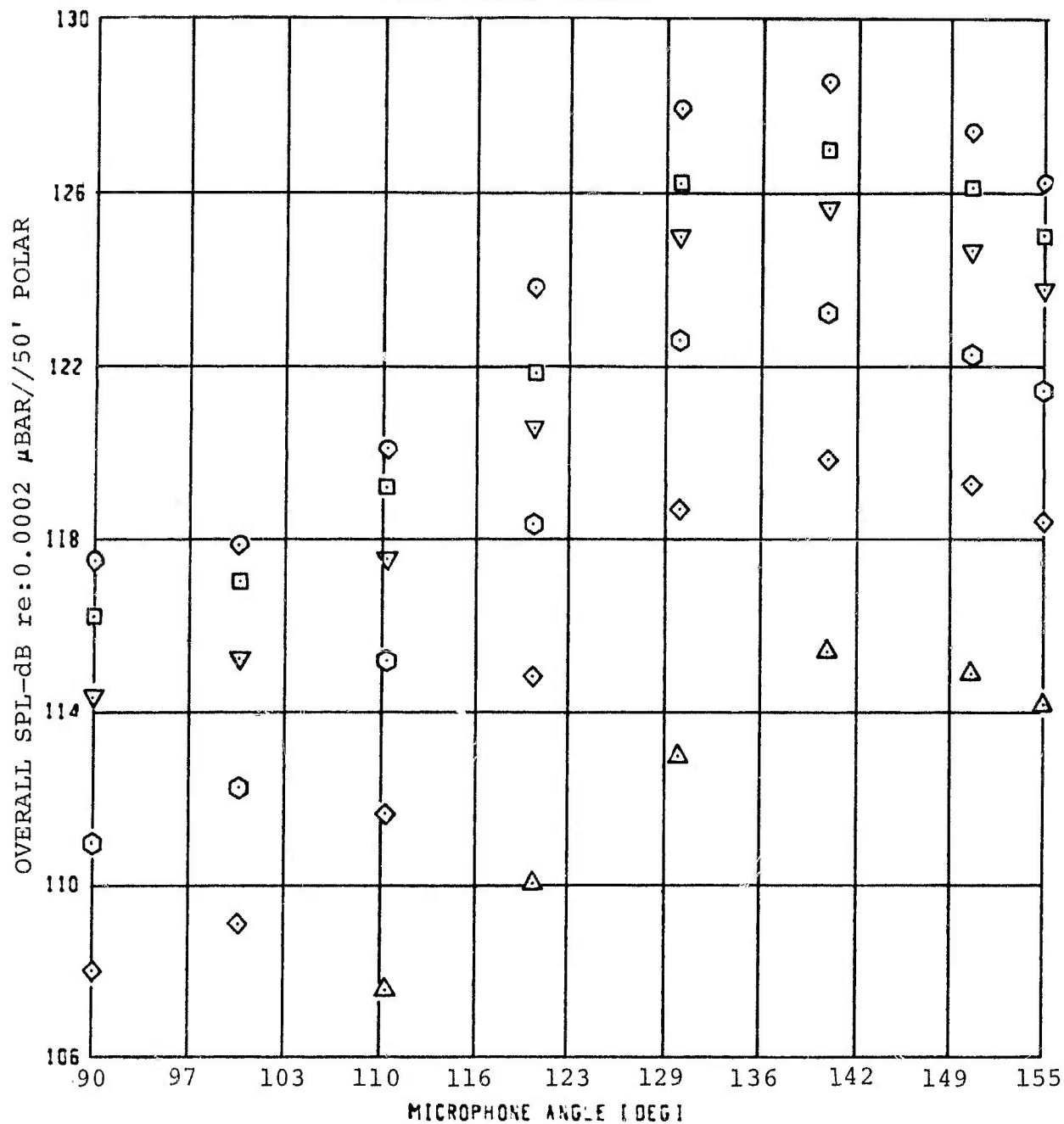
SPECTRA ARE FREE FIELD + 6dB



PLT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE: INLET	OBSERVED LOCATION	CASPL (DB)
○	1750	1150°F	2.000	130°	SCFP	119.0
□	1750	1150	2.500	↓	SCFP	124.7
x	1750	1150	3.000		SCFP	128.6
*	1750	1150	3.400		SCFP	130.9
△	1750	1150	3.700		SCFP	132.2
●	1750	1150	4.000		SCFP	133.8

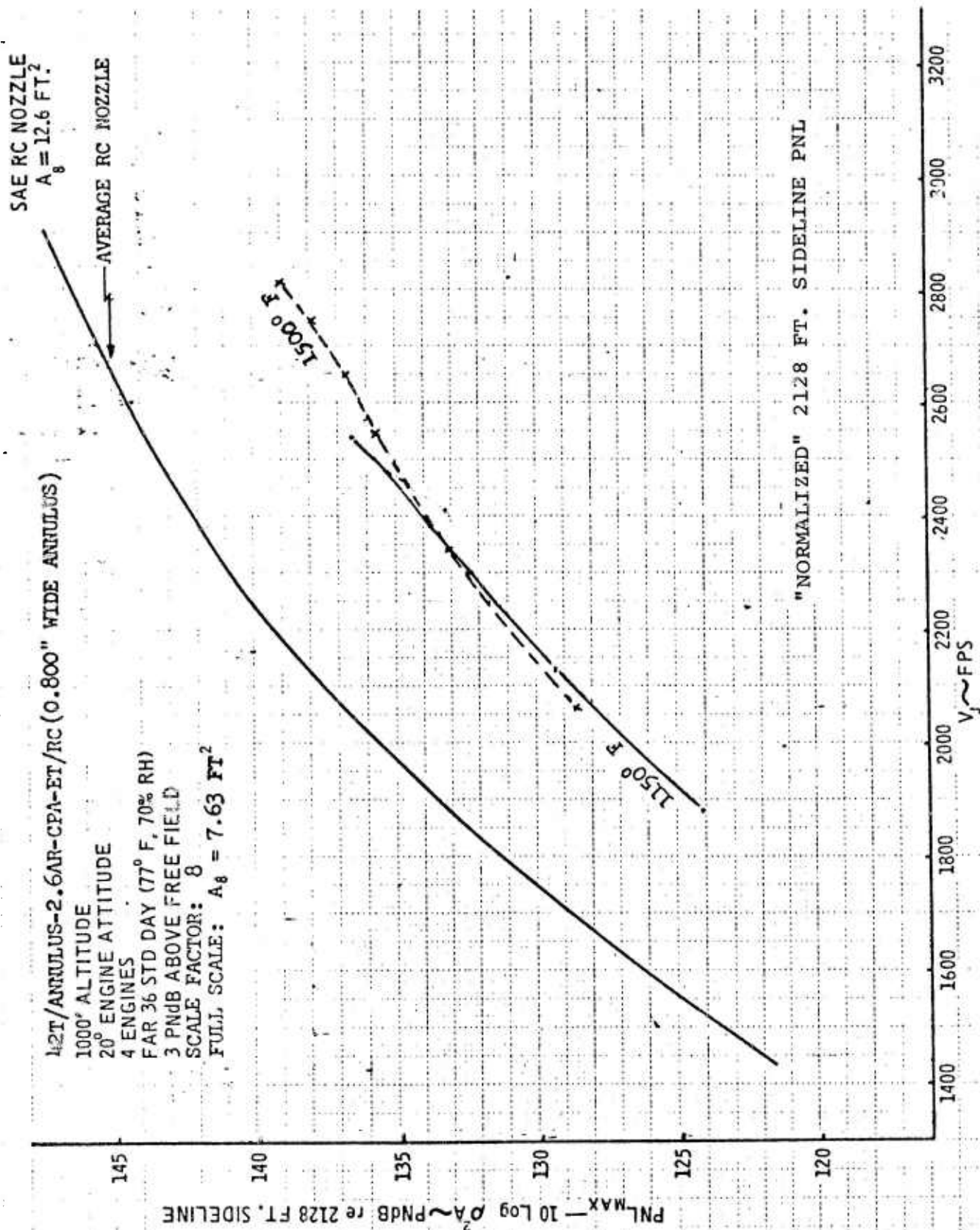
MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

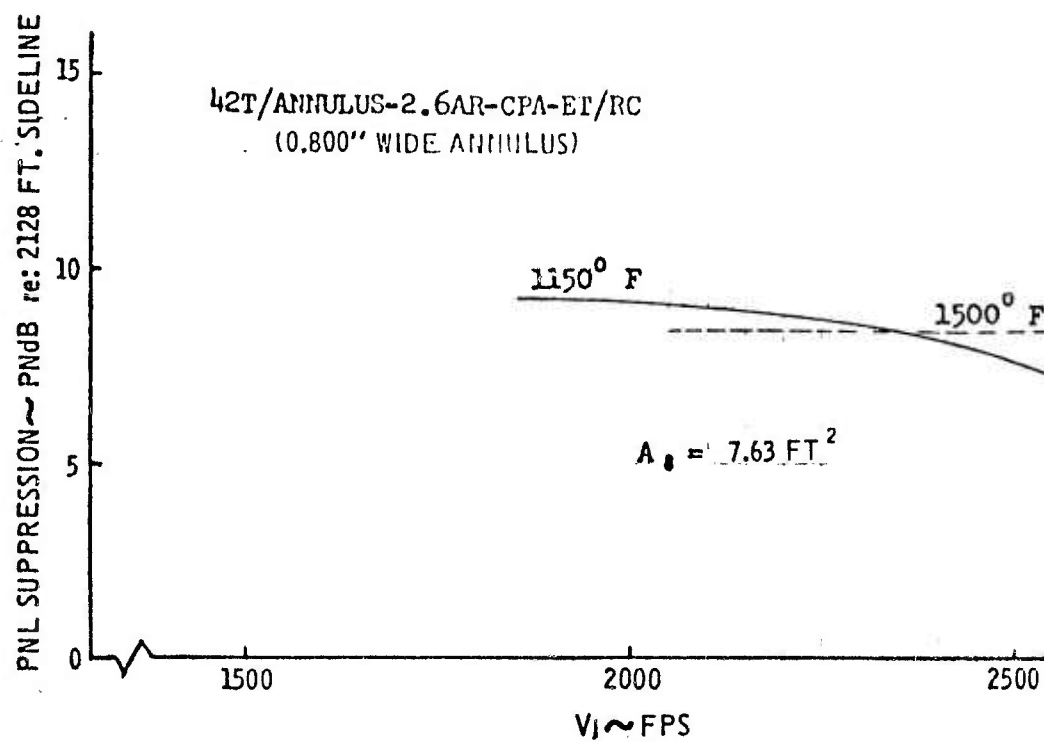
FREE FIELD VALUES



NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
(0.800" WIDE ANNULUS)

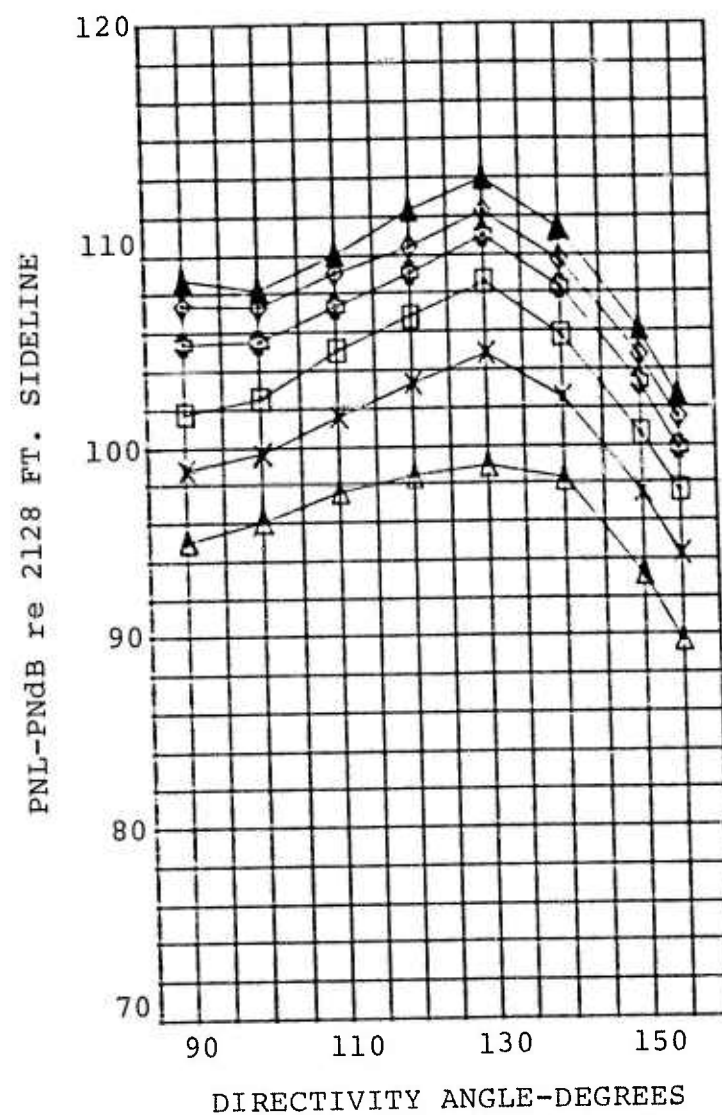
OASPL BEAM PATTERNS





PEAK PNL SUPPRESSION VALUES

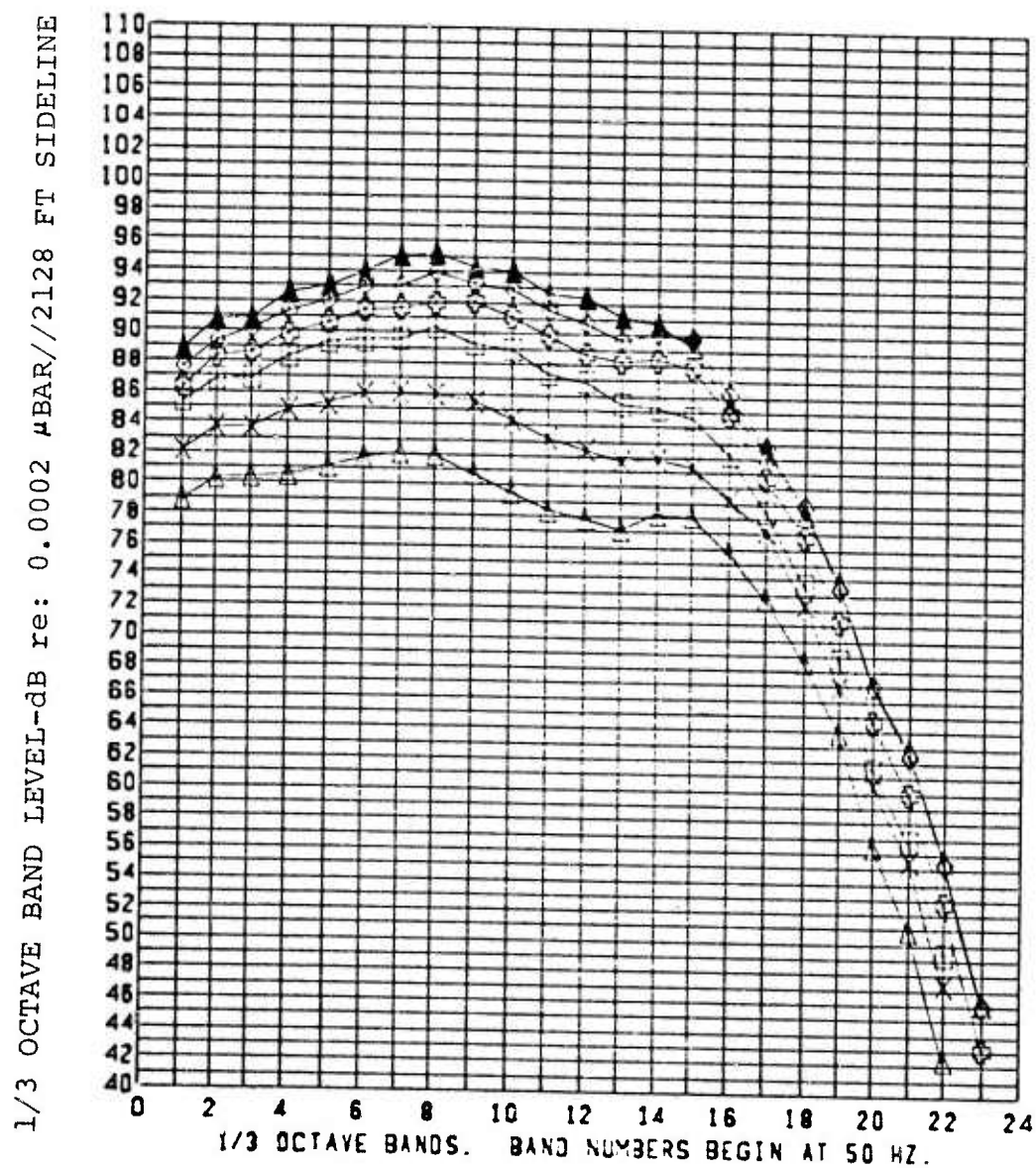
NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
(0.800" WIDE ANNULUS)



$T_t = 1150^\circ\text{F}$ $A_8 = 7.63 \text{ FT}^2$ RUN: 175
PR = Δ 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7, \blacktriangle 4.0

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

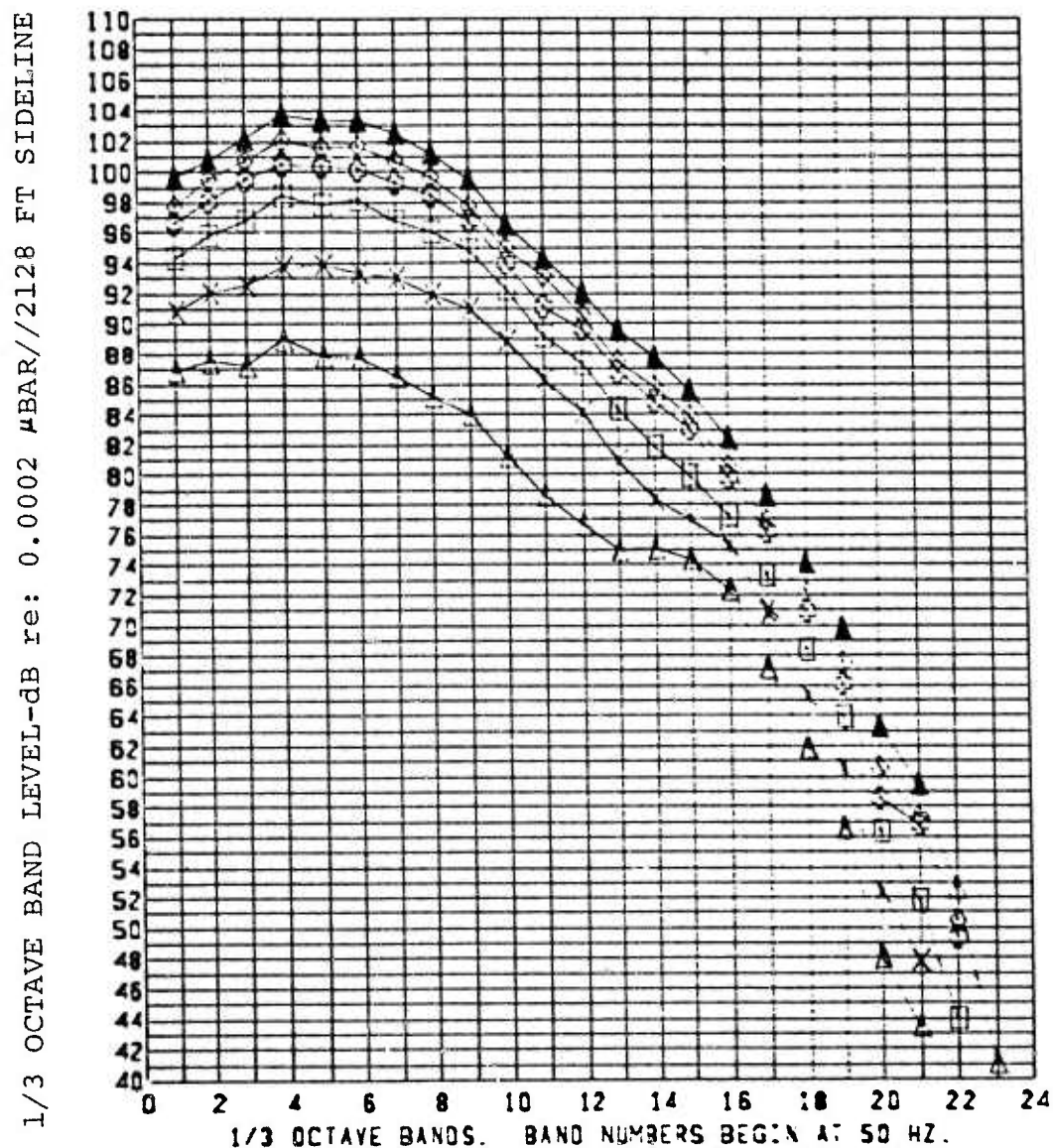


TT = 1150°F A8 = 7.63 FT² RUN: 175
 PR = △ 2.0, ✕ 2.5, □ 3.0, + 3.4, ◆ 3.7, ▲ 4.0
 NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
 (0.800" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



$T_t = 1150^\circ\text{F}$ $A_8 = 7.63 \text{ FT}^2$ RUN: 175

PR = \triangle 2.0, X 2.5, \square 3.0, \oplus 3.4, \diamond 3.7, \blacktriangle 4.0

NOZZLE: 42T/ANNULUS-2.6AR-CPA-ET/RC
(0.800' WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/Annulus-2.4AR-CPA-ET/RC

FACILITY:

DATE: 10-15-73

T_{AMB} = 61°F

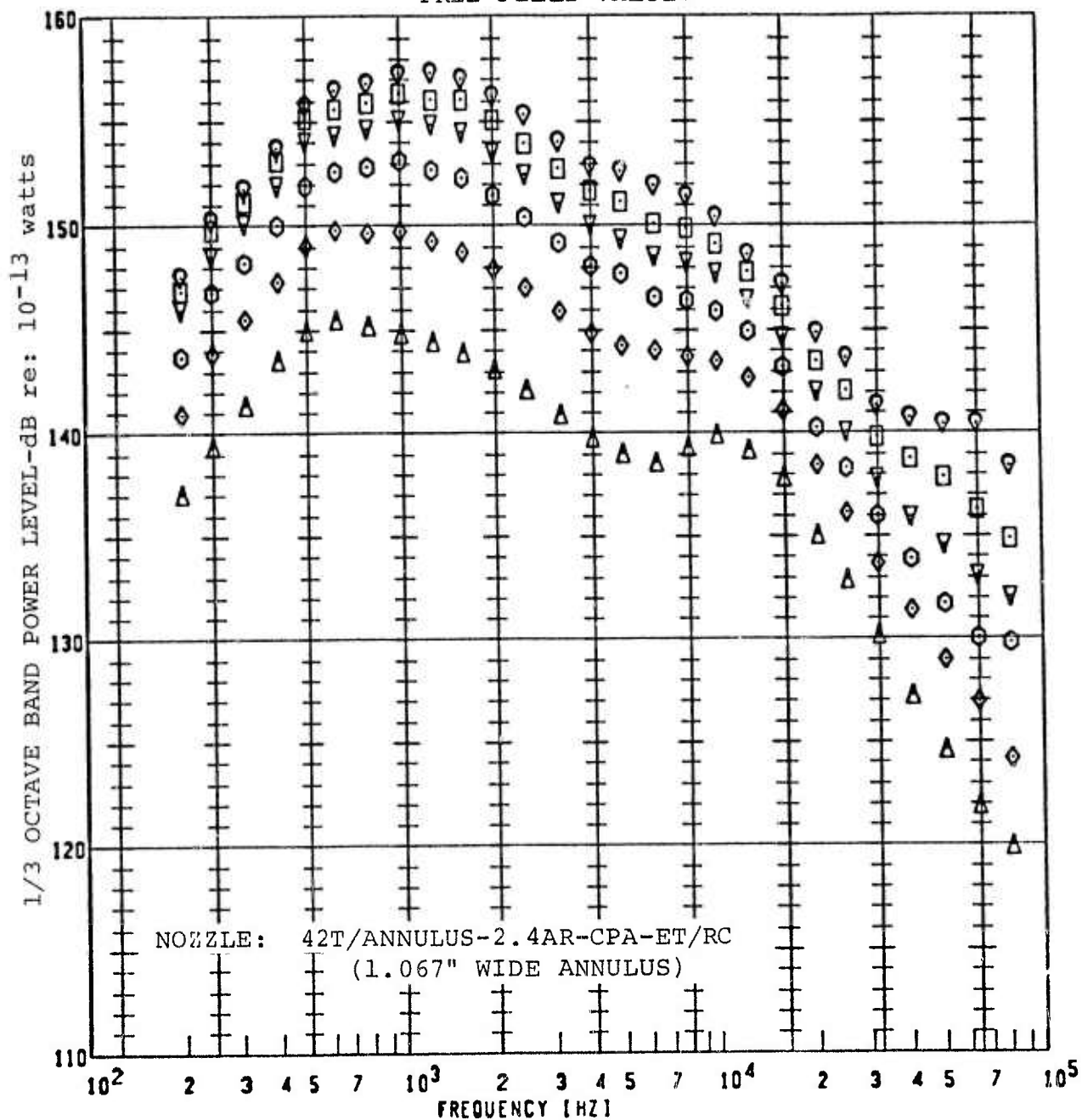
R.H. = 82%

SCALE MODEL A₈ = 18.9 in.²

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
167	2.0	1150°F	1875 fps	Annulus width =	
"	2.5	"	2126	1.067"	
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

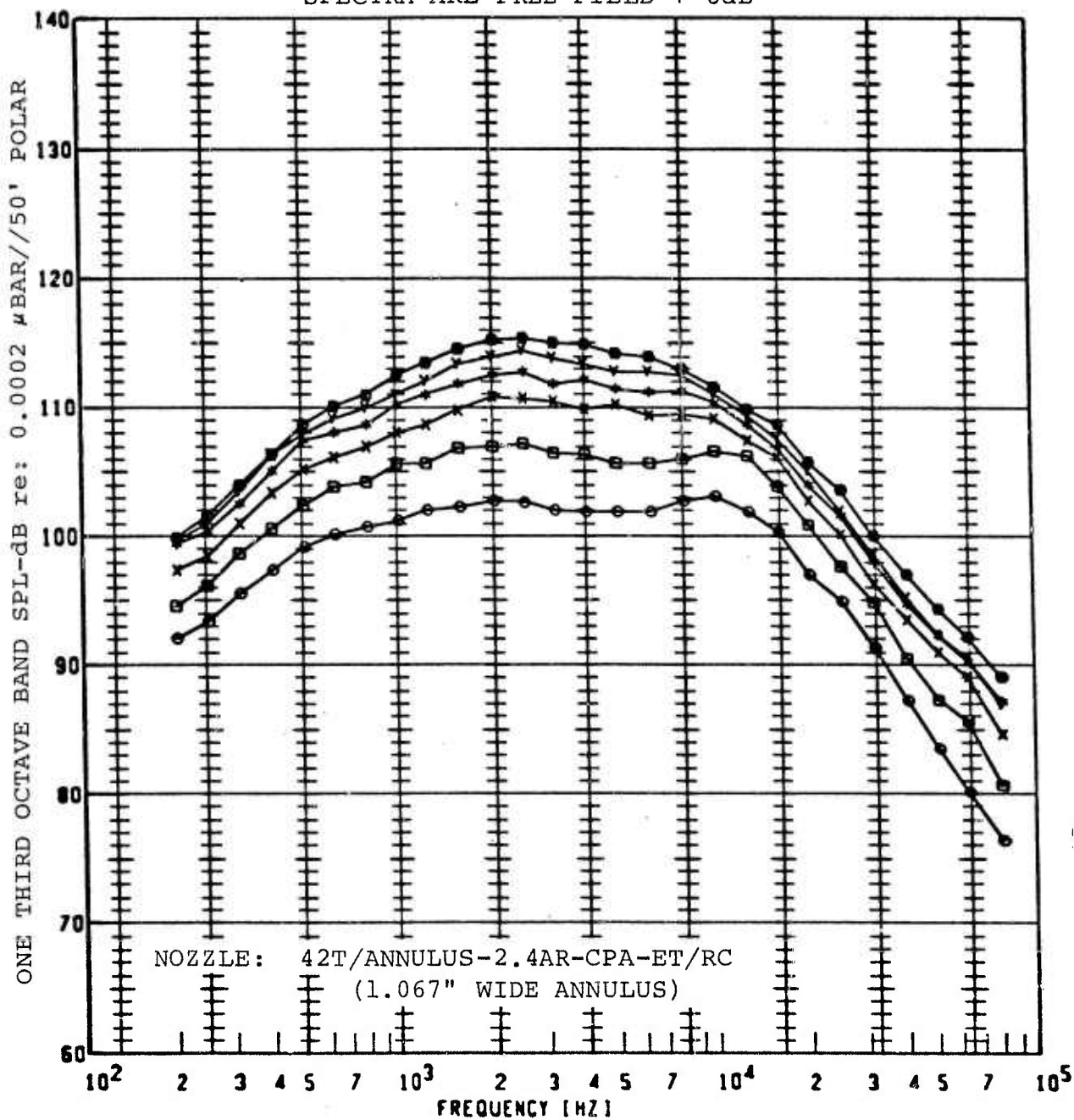
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	167	2.00	1150°F
◇	167	2.50	1150
○	167	3.00	1150
▽	167	3.40	1150
□	167	3.70	1150
⊙	167	4.00	1150

JET NOISE POWER SPECTRA

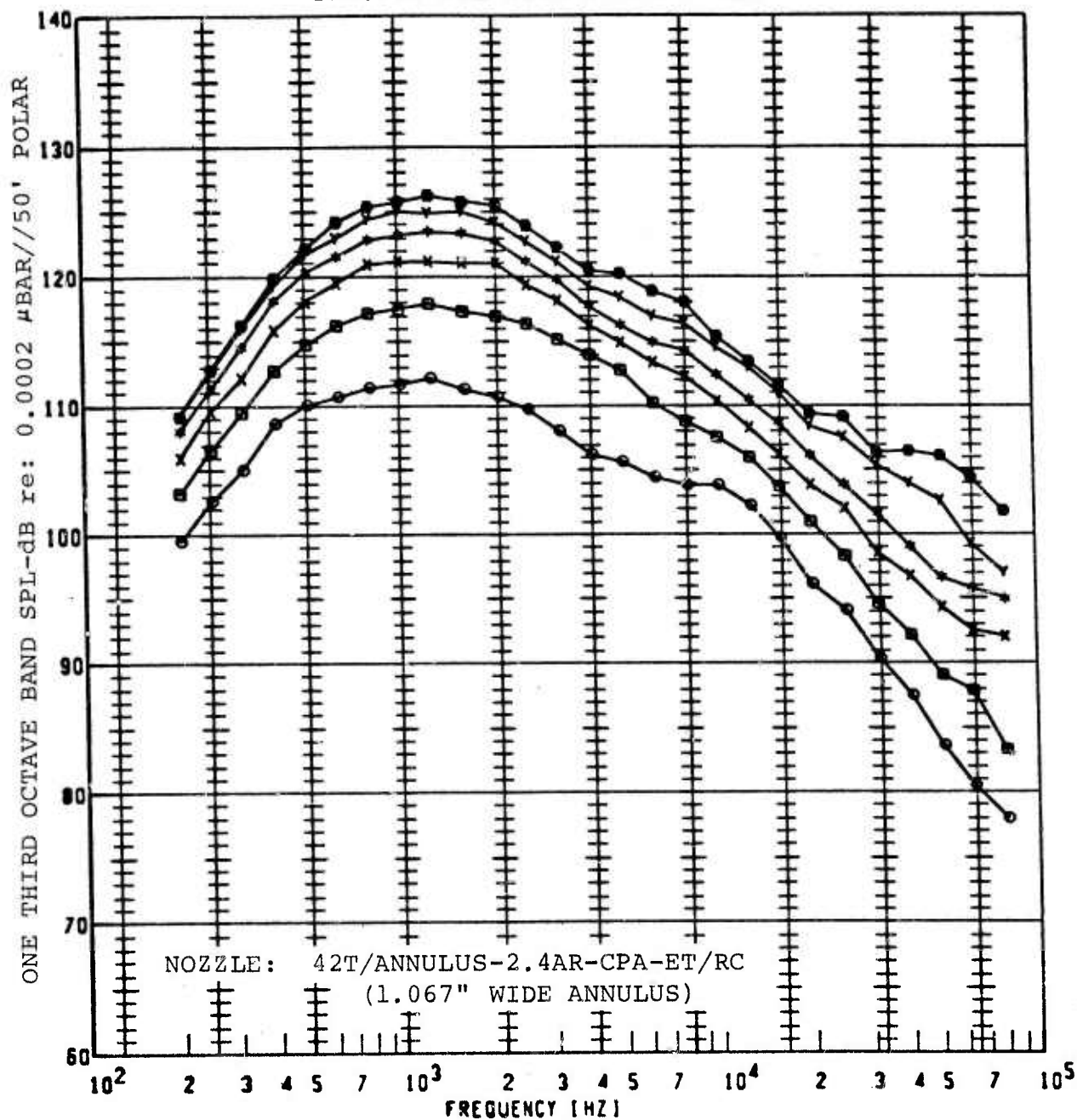
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	167G	1150°F	2.000	110°	50FP	114.2
■	167G	1150	2.500	↓	50FP	118.2
x	167G	1150	3.000	↓	50FP	121.3
*	167G	1150	3.400	↓	50FP	123.0
v	167G	1150	3.700	↓	50FP	124.3
●	167G	1150	4.000	↓	50FP	125.4

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

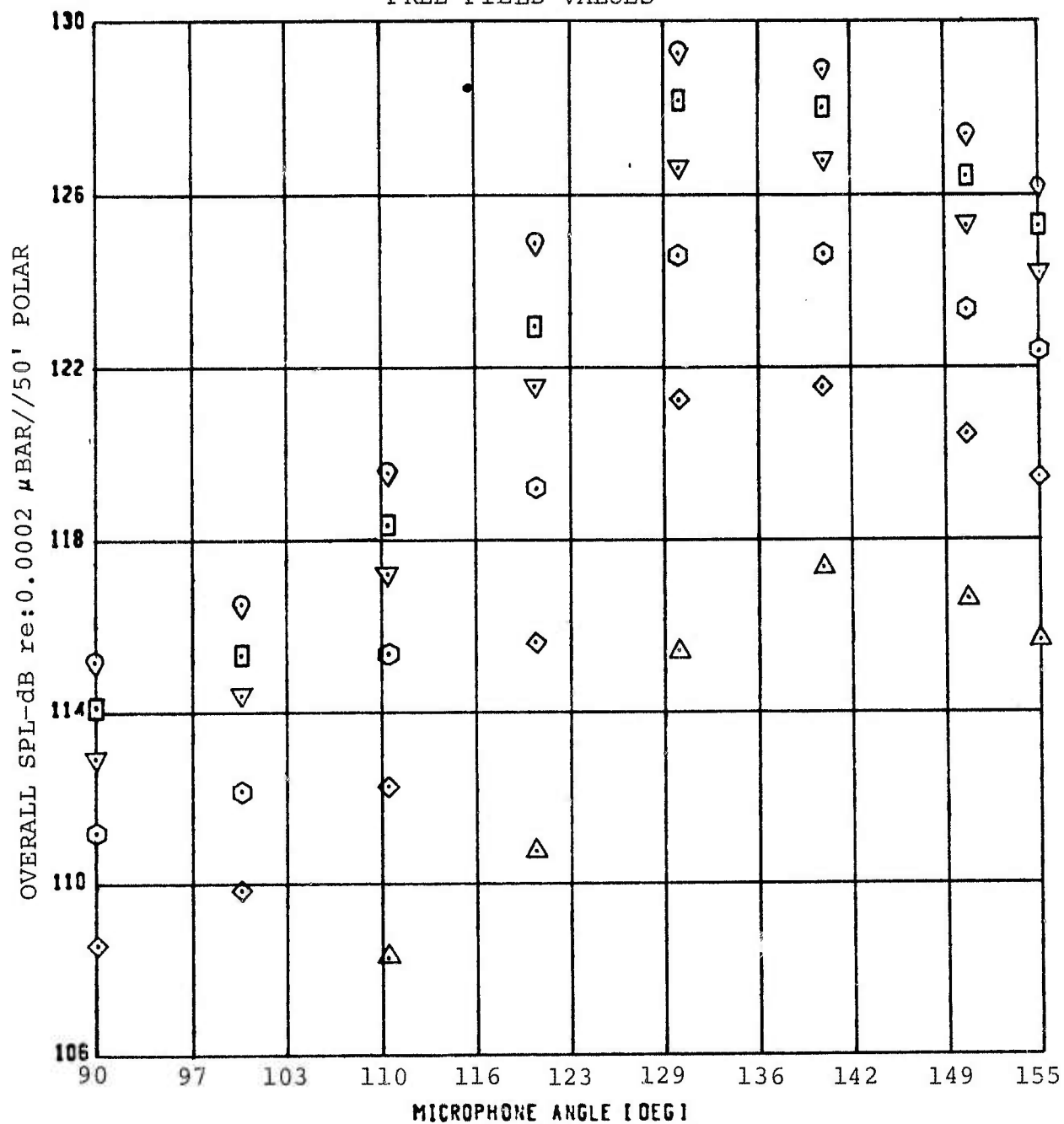
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OSPL (DB)
●	167G	1150°F	2.000	130°	50FP	121.5
■	167G	1150	2.500		50FP	127.3
x	167G	1150	3.000		50FP	130.6
+	167G	1150	3.400		50FP	132.6
y	167G	1150	3.700		50FP	134.2
●	167G	1150	4.000		50FP	135.2

MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

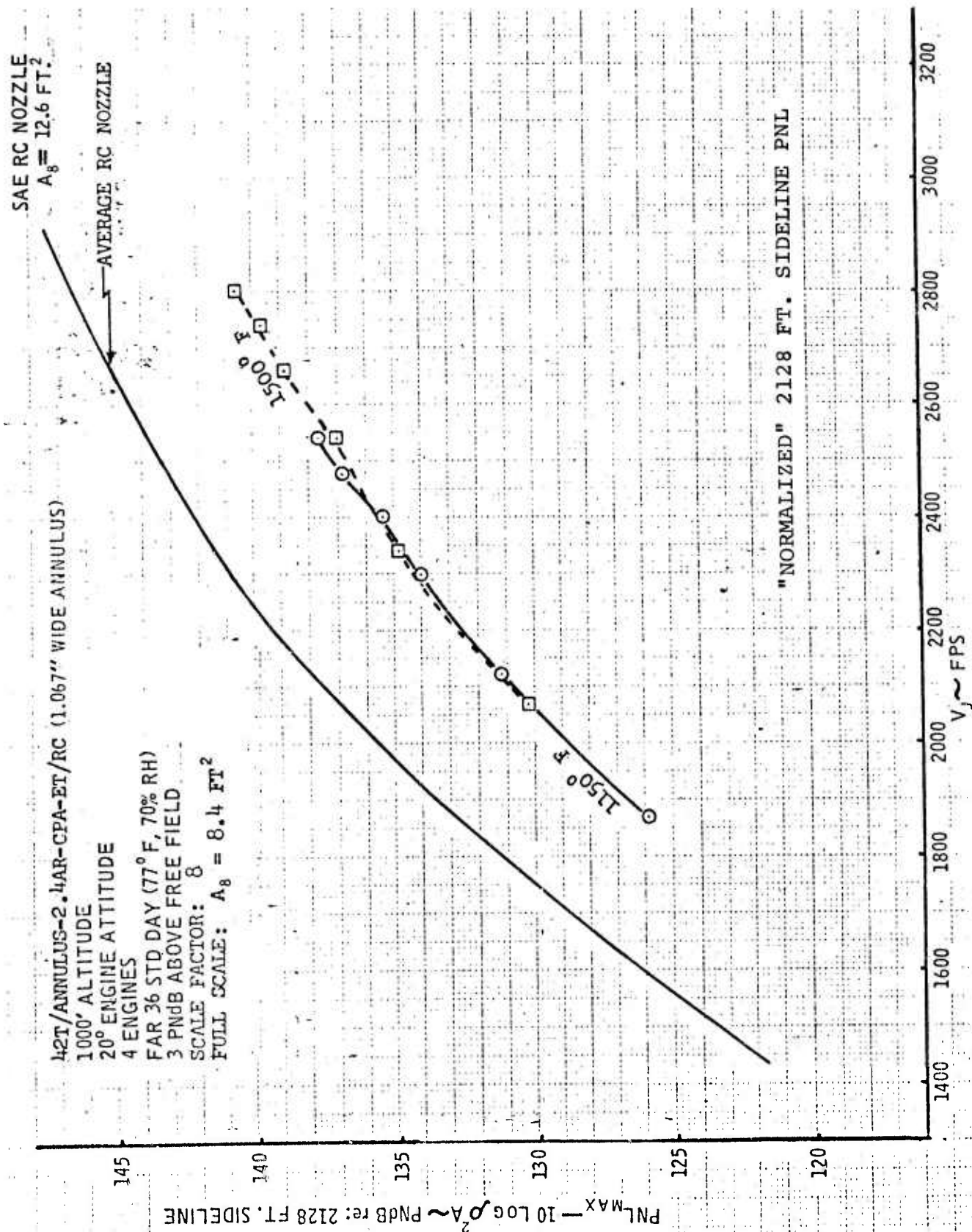
FREE FIELD VALUES

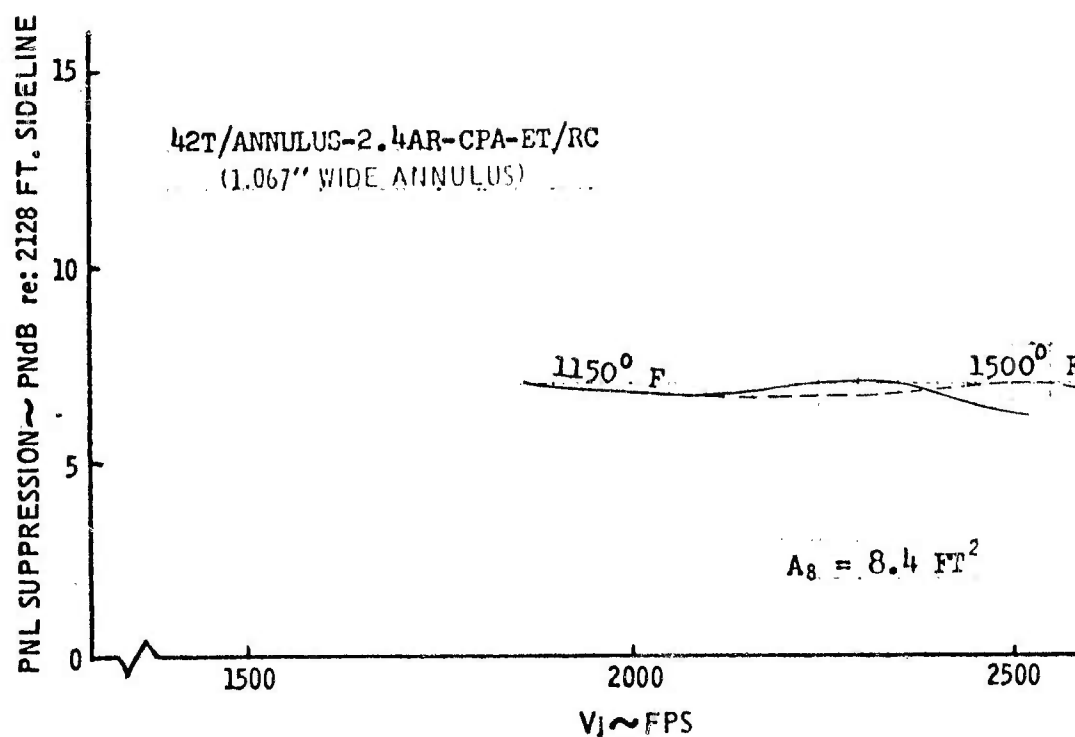


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	167	2.00	1150°F
◇	167	2.50	1150
○	167	3.00	1150
▽	167	3.40	1150
□	167	3.70	1150
⊙	167	4.00	1150

NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
(1.067" WIDE ANNULUS)

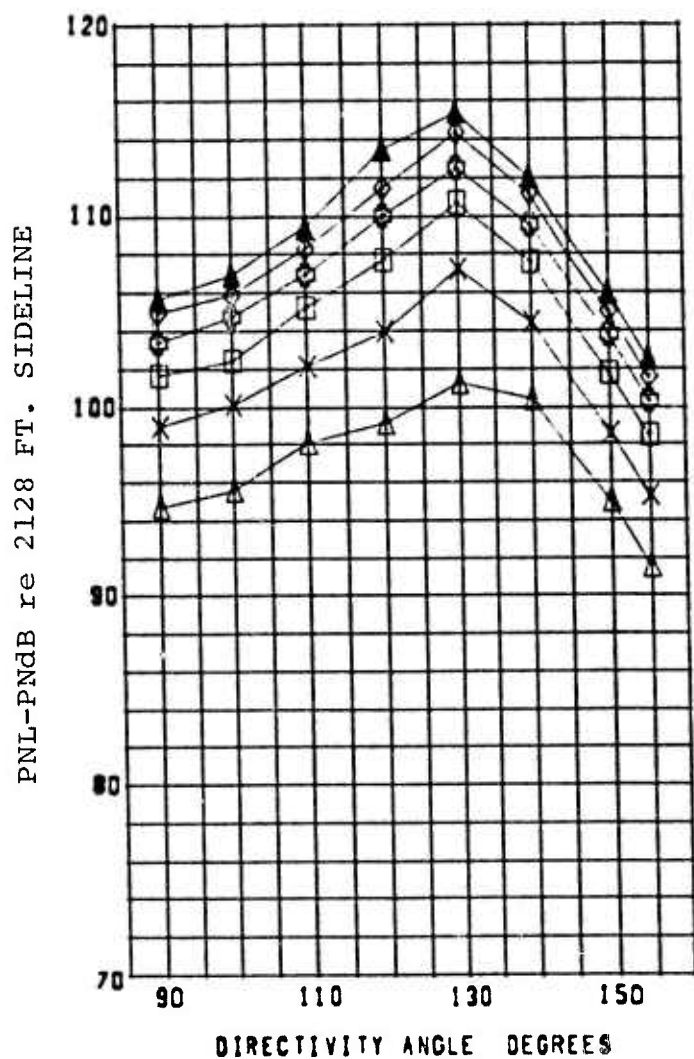
OASPL BEAM PATTERNS





PEAK PNL SUPPRESSION VALUES

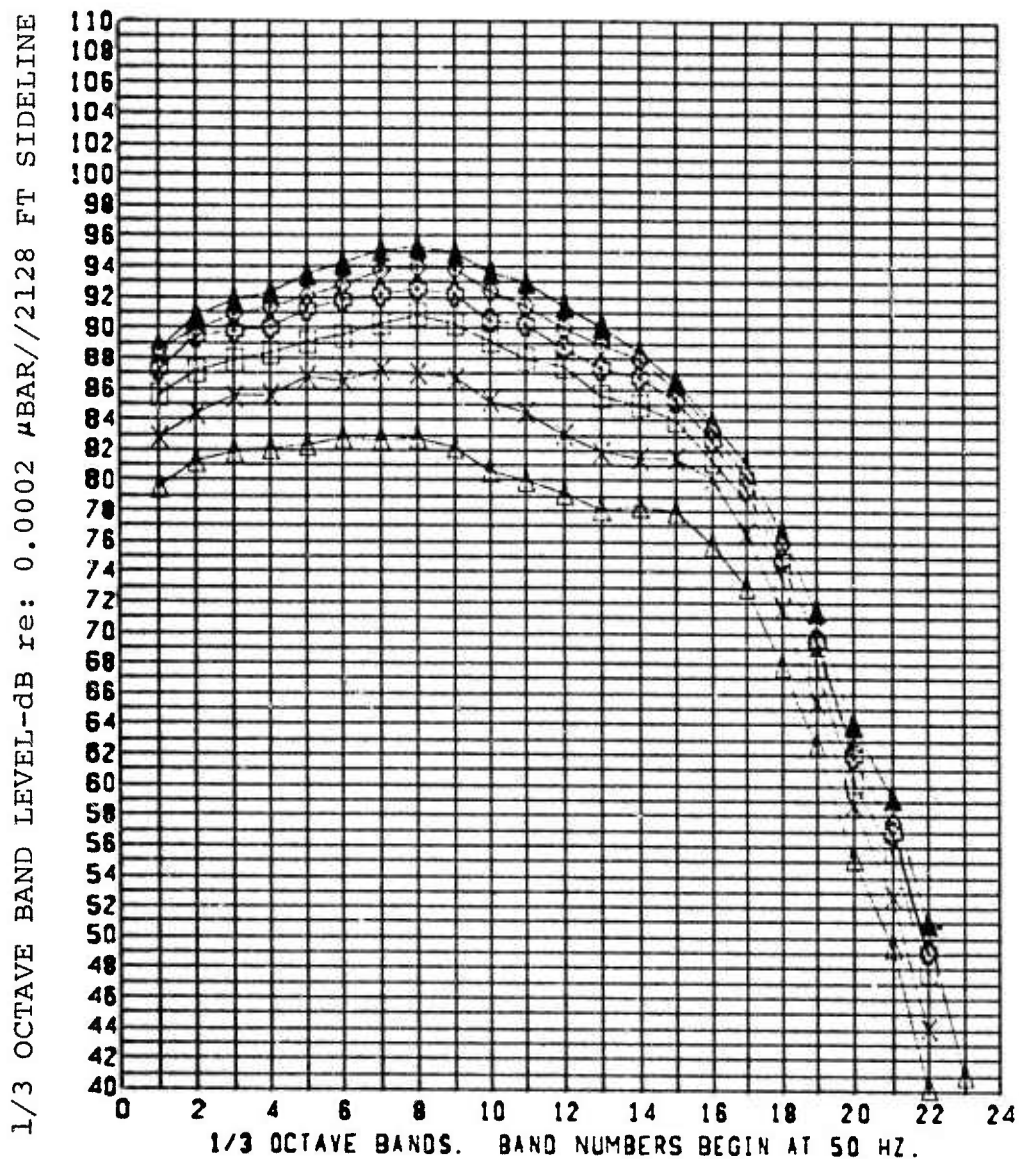
NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
(1.067" WIDE ANNULUS)



$T_t = 1150^\circ\text{F}$ $A_8 = 8.4 \text{ FT}^2$ RUN: 167
PR = $\triangle 2.0$, $\times 2.5$, $\square 3.0$, $+ 3.4$, $\diamond 3.7$, $\blacktriangle 4.0$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES
 ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT



$T_t = 1150^\circ\text{F}$ $A_8 = 8.4 \text{ FT}^2$ RUN: 167

PR = Δ 2.0, \times 2.5, \square 3.0, $+$ 3.4, \diamond 3.7, \blacktriangle 4.0

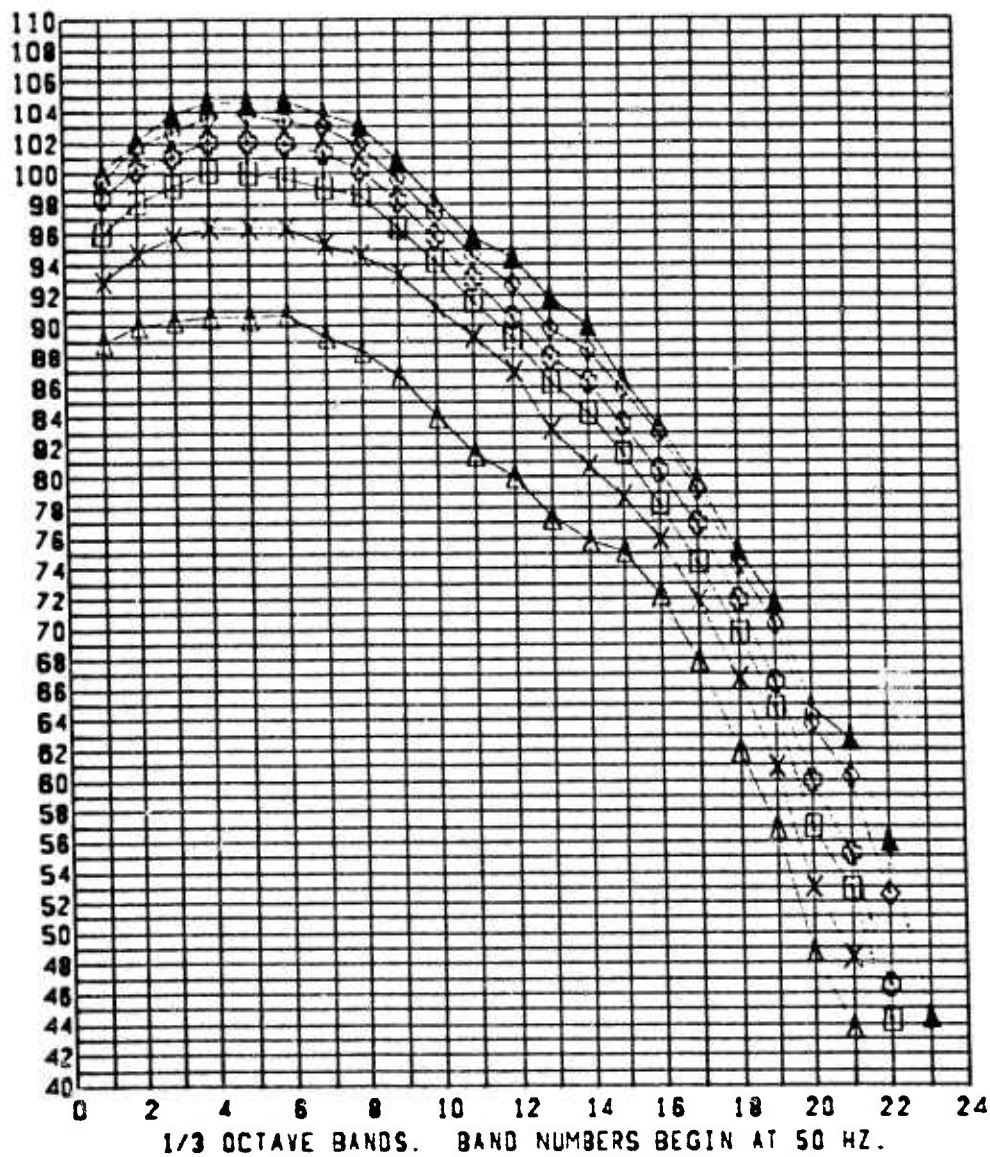
NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
 (1.067" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



TT = 1150°F A8 = 8.4 FT² RUN: 167
PR = △ 2.0, × 2.5, □ 3.0, + 3.4, ◆ 3.7, ▲ 4.0

NOZZLE: 42T/ANNULUS-2.4AR-CPA-ET/RC
(1.067" WIDE ANNULUS)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
re: NOZZLE INLET AXIS

TEST CONDITIONS

NOZZLE: 42T/Annulus-2.1AR-CPA'-ET/RC

FACILITY: HNTF

DATE: 10-16-73

T_{AMB} = 58°F

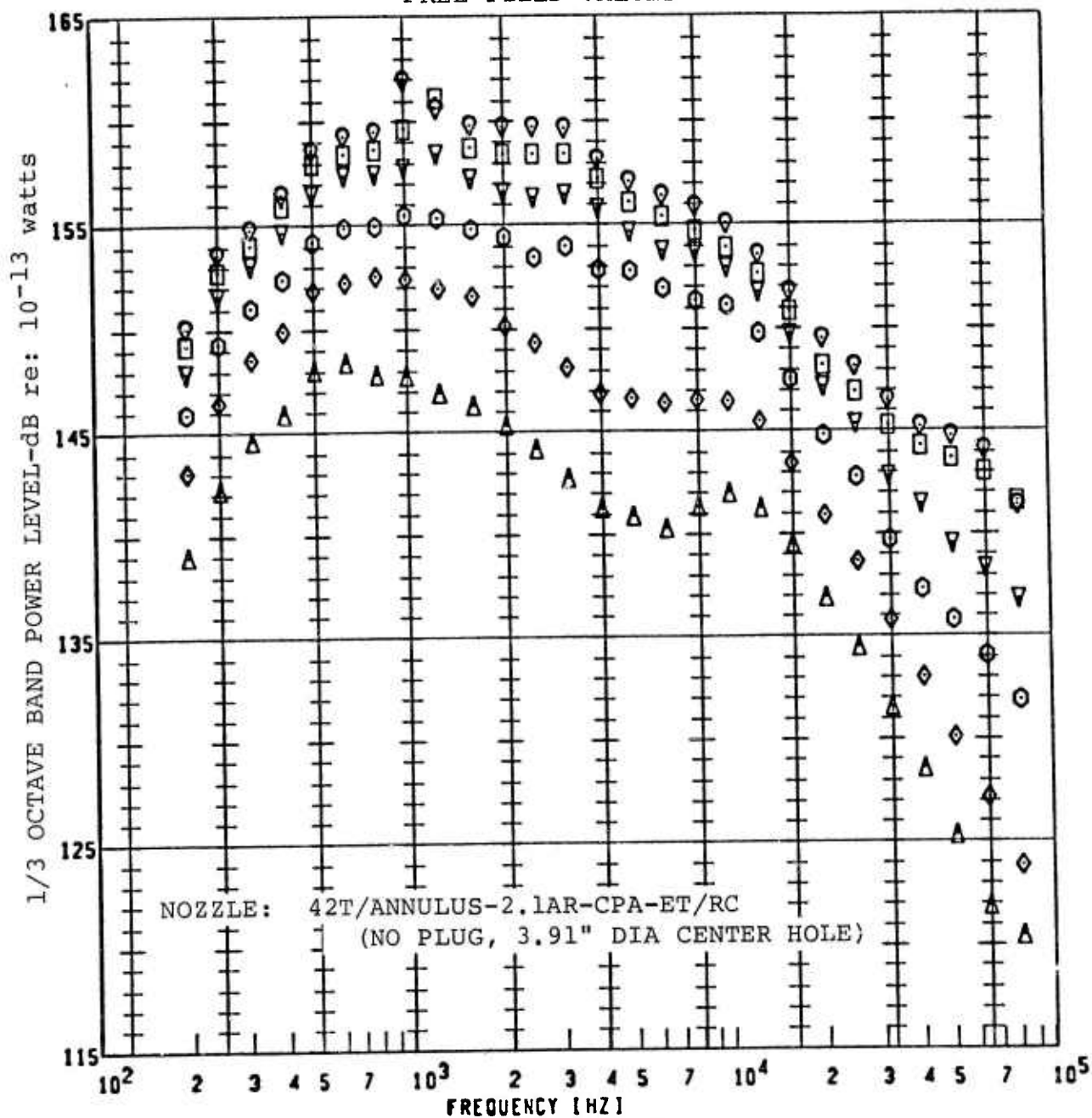
R.H. = 83%

SCALE MODEL $A_8 = 21.3 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
171	2.0	1150°F	1875 fps	No Plug,	
"	2.5	"	2126	3.91" Dia. center hole	
"	3.0	"	2303		
"	3.4	"	2413		
"	3.7	"	2483		
"	4.0	"	2544		

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

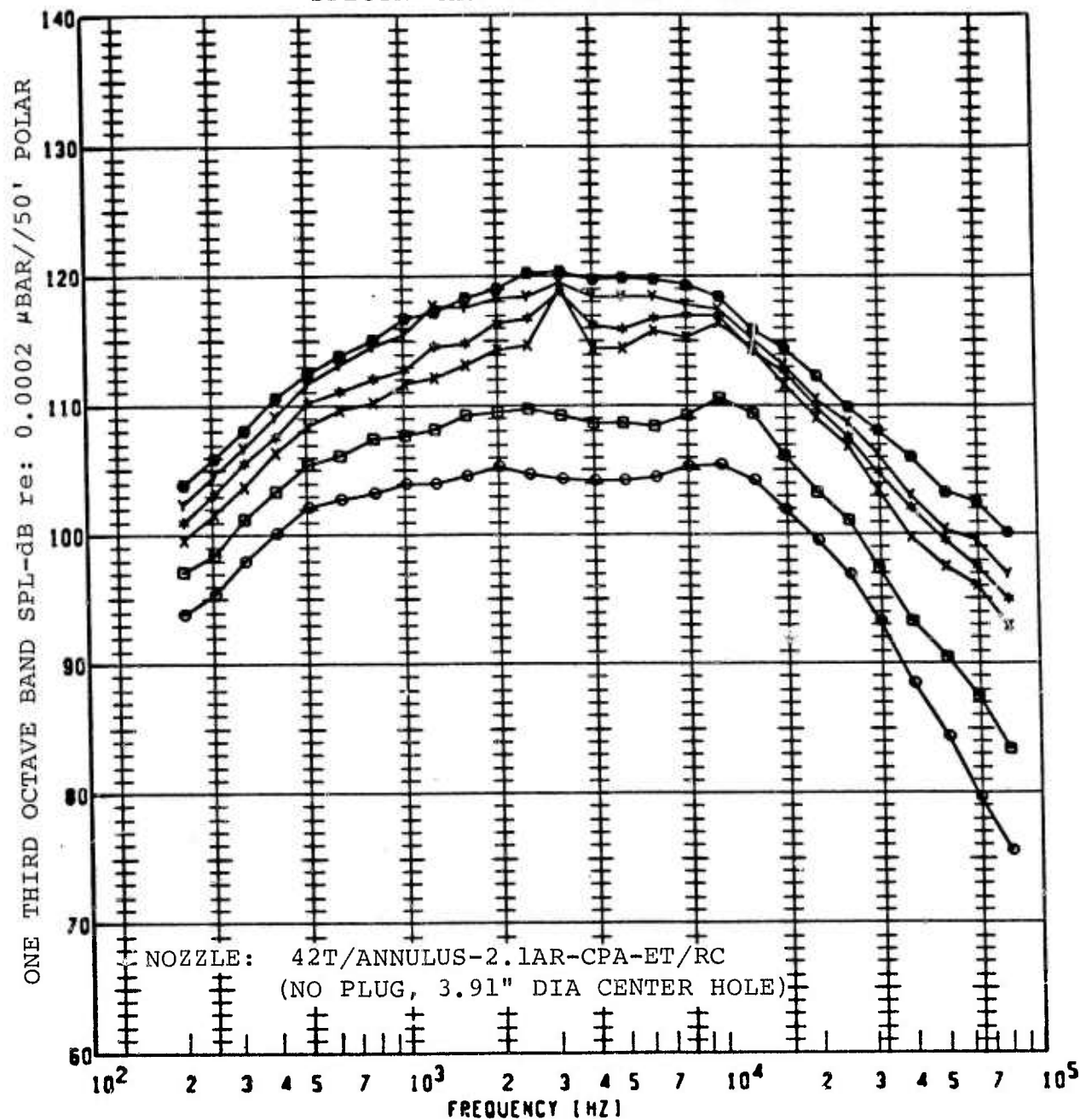
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	171	2.00	1150°F
◇	171	2.50	1150
○	171	3.00	1150
▽	171	3.40	1150
□	171	3.70	1150
◊	171	4.00	1150

JET NOISE POWER SPECTRA

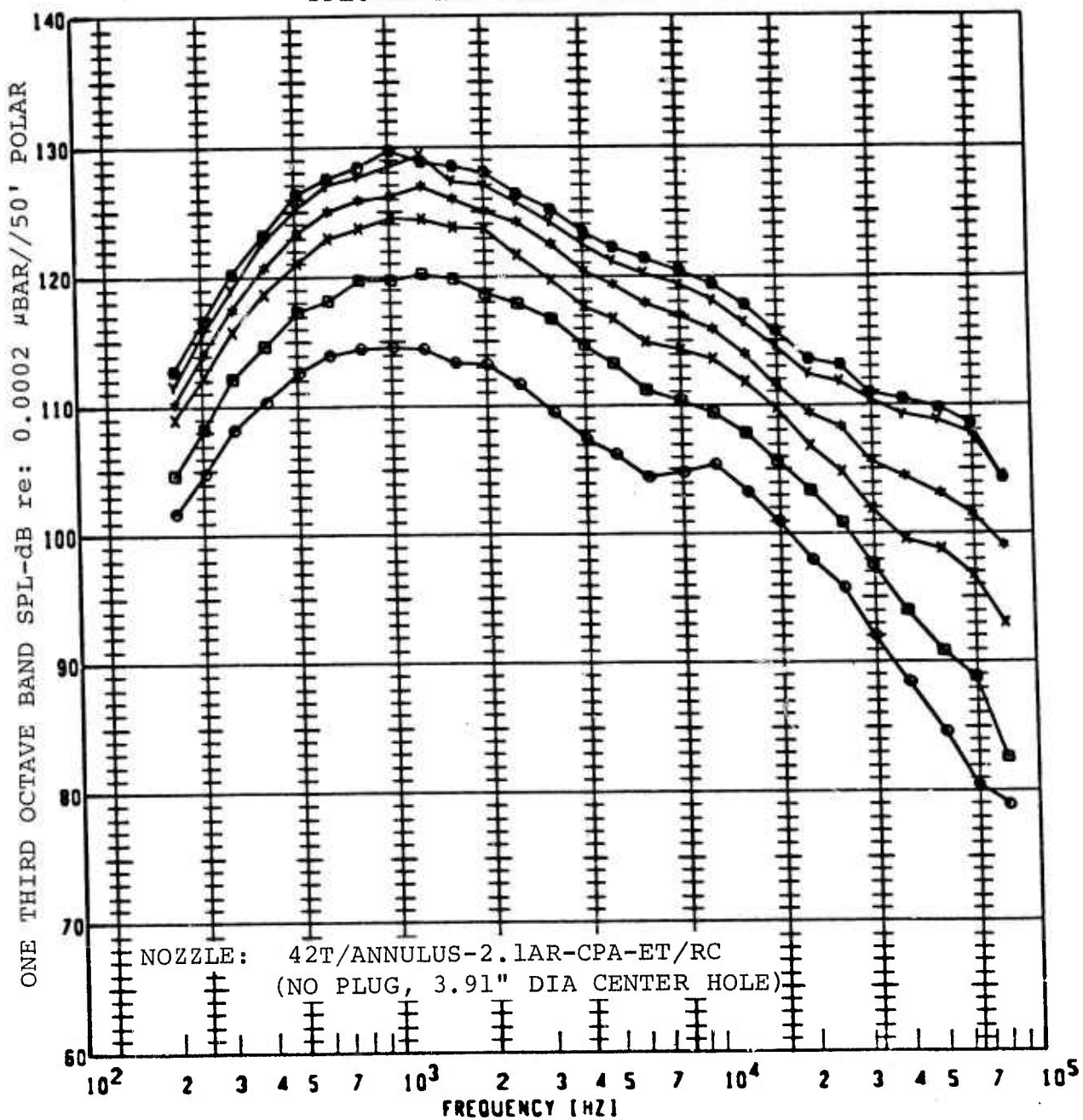
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	171G	1150°F	2.000	110°	50FP	116.6
■	171G	1150	2.500	↓	50FP	121.0
x	171G	1150	3.000	↓	50FP	126.6
*	171G	1150	3.400	↓	50FP	127.7
y	171G	1150	3.700	↓	50FP	129.4
●	171G	1150	4.000	↓	50FP	130.4

MEASURED NOISE SPECTRA AT 110° re: NOZZLE INLET AXIS

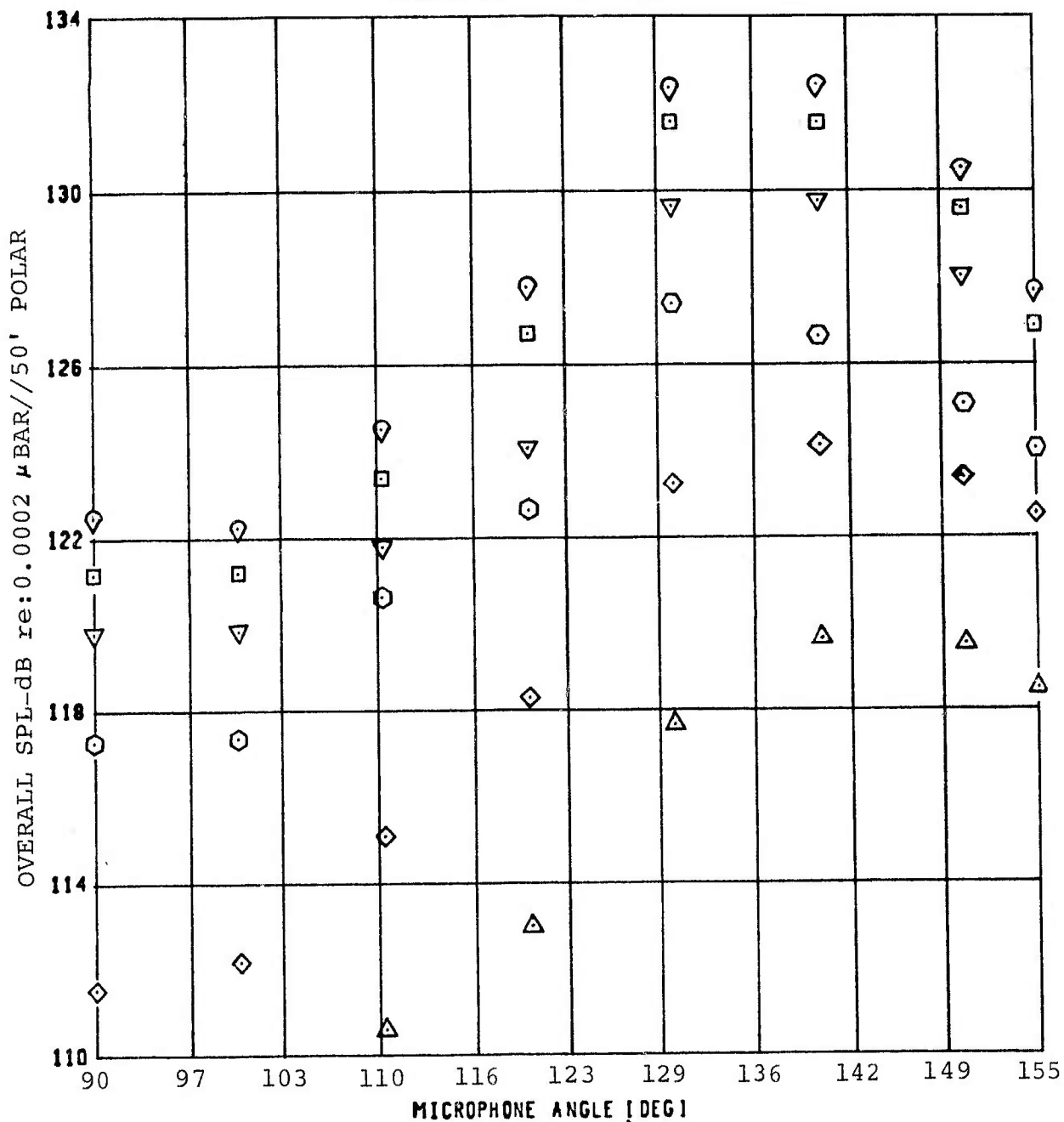
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
●	171G	1150°F	2.000	130°	50FP	123.8
■	171G	1150	2.500		50FP	129.3
x	171G	1150	3.000		50FP	133.4
*	171G	1150	3.400		50FP	135.6
▼	171G	1150	3.700		50FP	137.6
●	171G	1150	4.000		50FP	138.3

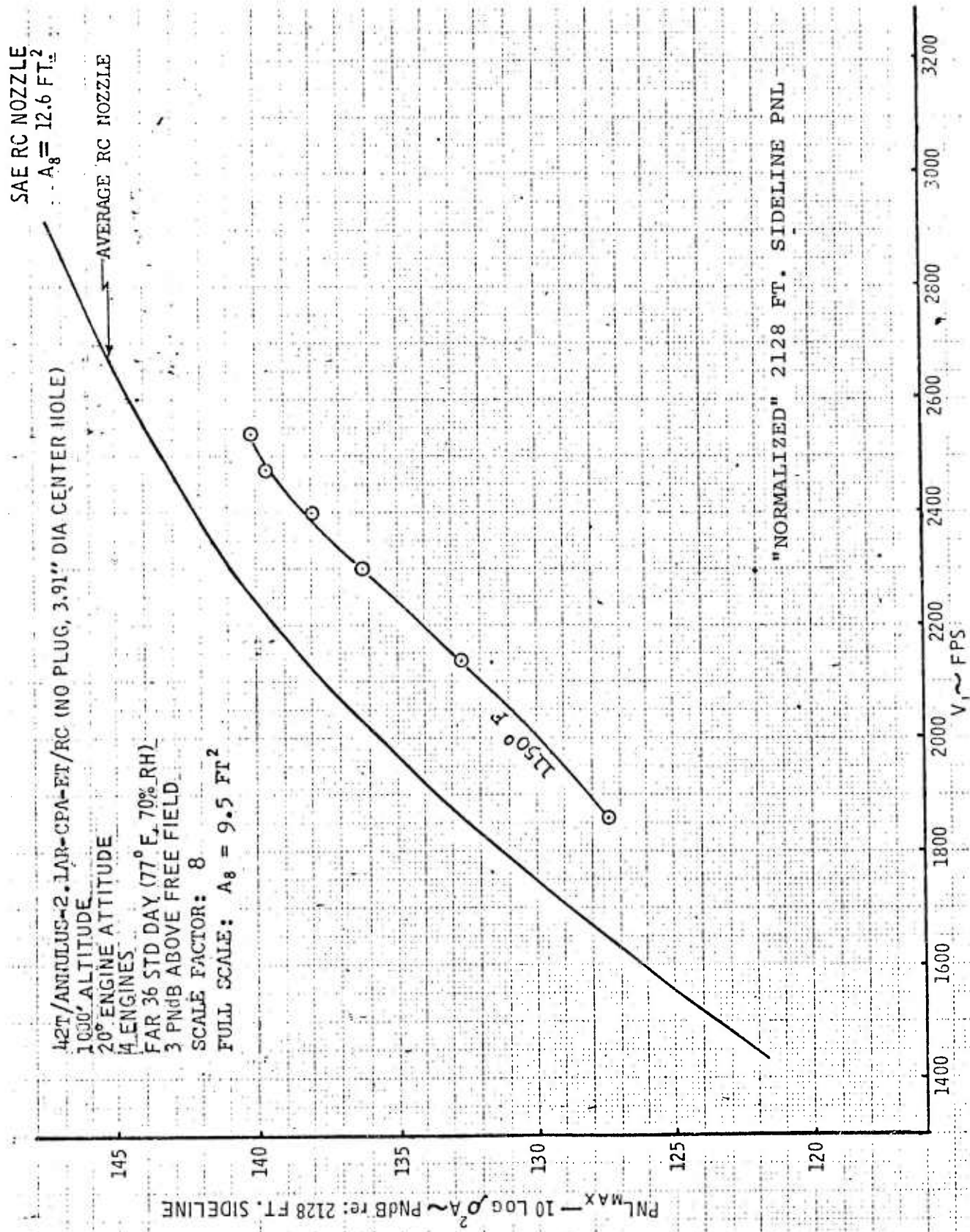
MEASURED NOISE SPECTRA AT 130° re: NOZZLE INLET AXIS

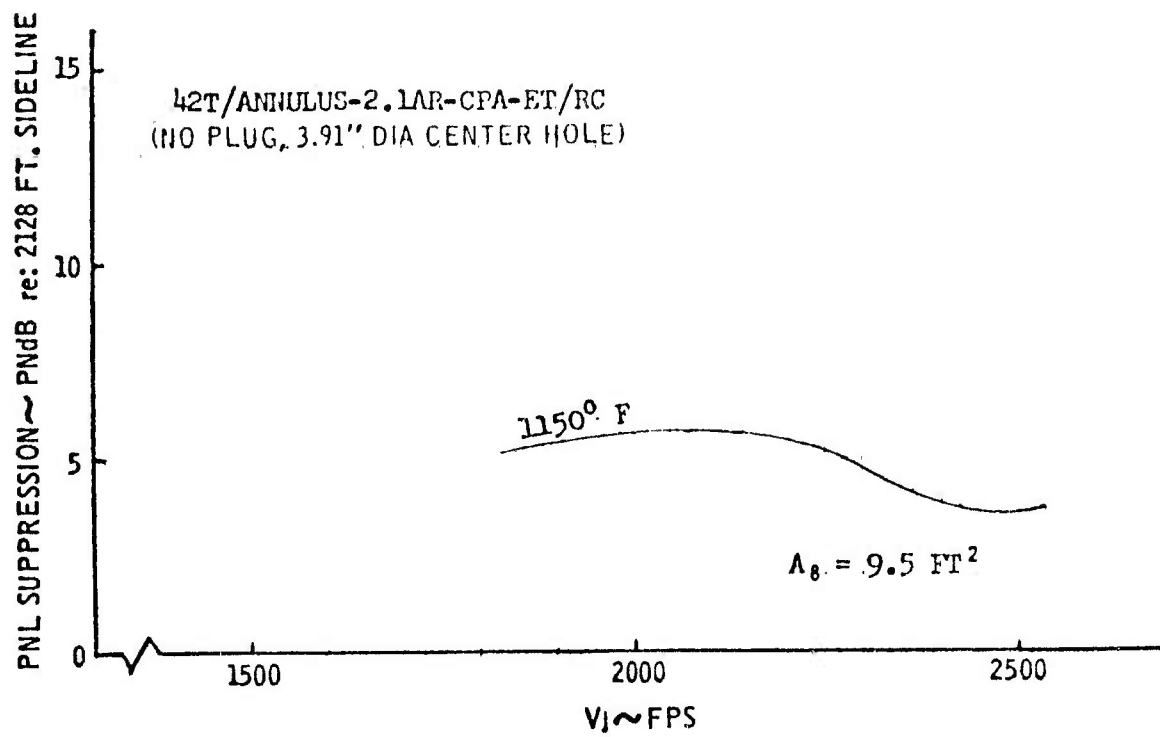
FREE FIELD VALUES



NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
(NO PLUG, 3.91" DIA CENTER HOLE)

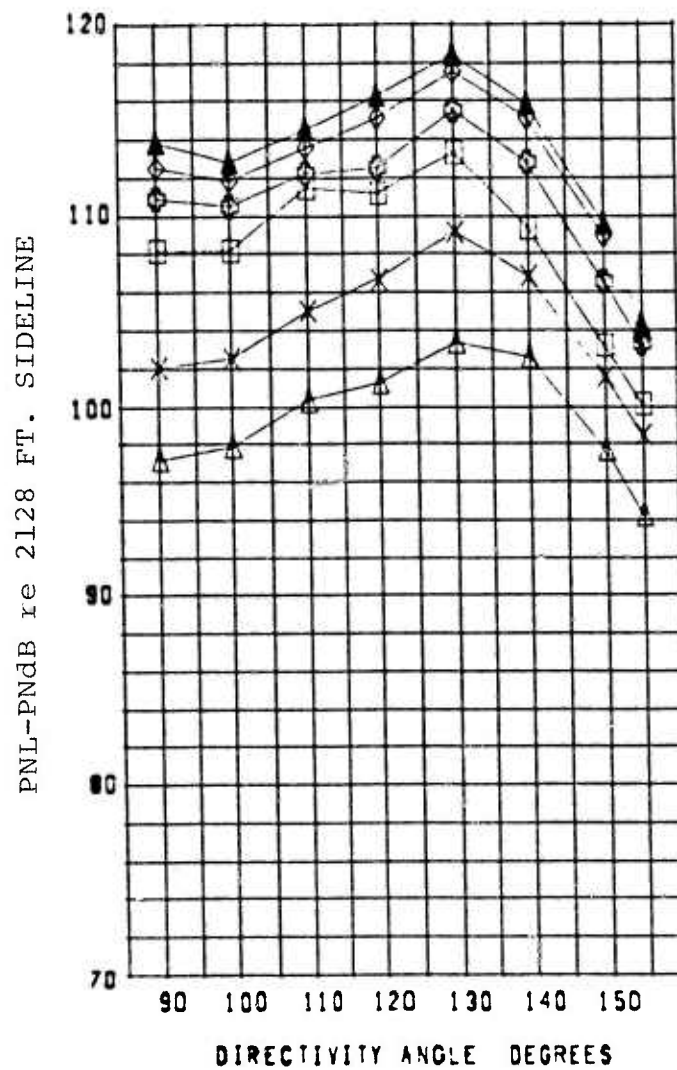
OASPL BEAM PATTERNS





PEAK PNL SUPPRESSION VALUES

NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
(NO PLUG, 3.910" CENTER HOLE)



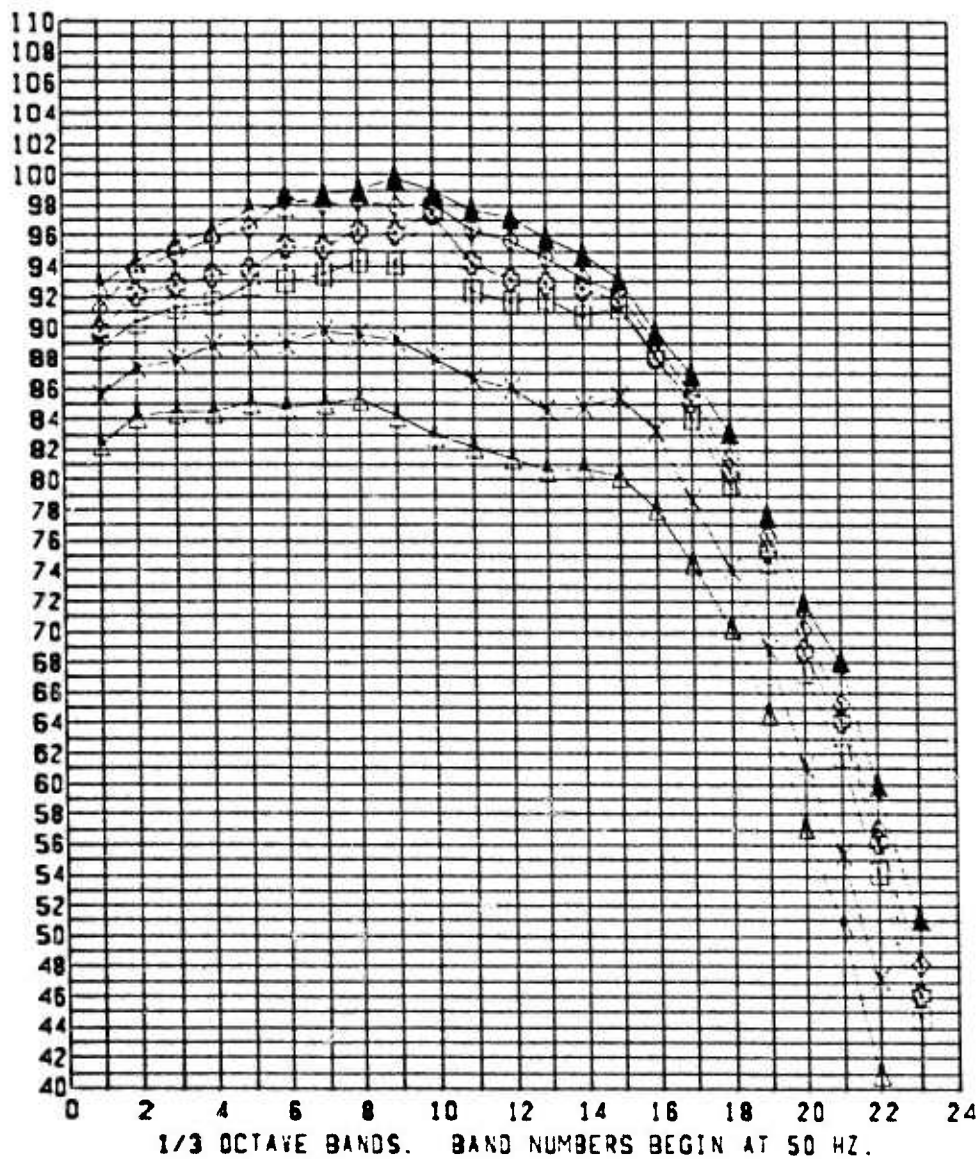
$T_T = 1150^\circ\text{F}$ $A_8 = 9.5 \text{ FT}^2$ RUN: 171
PR = $\triangle 2.0$, $\times 2.5$, $\square 3.0$, $+ 3.4$, $\diamond 3.7$, $\blacktriangle 4.0$

PNL BEAM PATTERNS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 110 DEG TEMP = 77 DEG R.H. = 70 PER CENT

1/3 OCTAVE BAND LEVEL-dB re: 0.0002 μ BAR//2128 FT SIDELINE



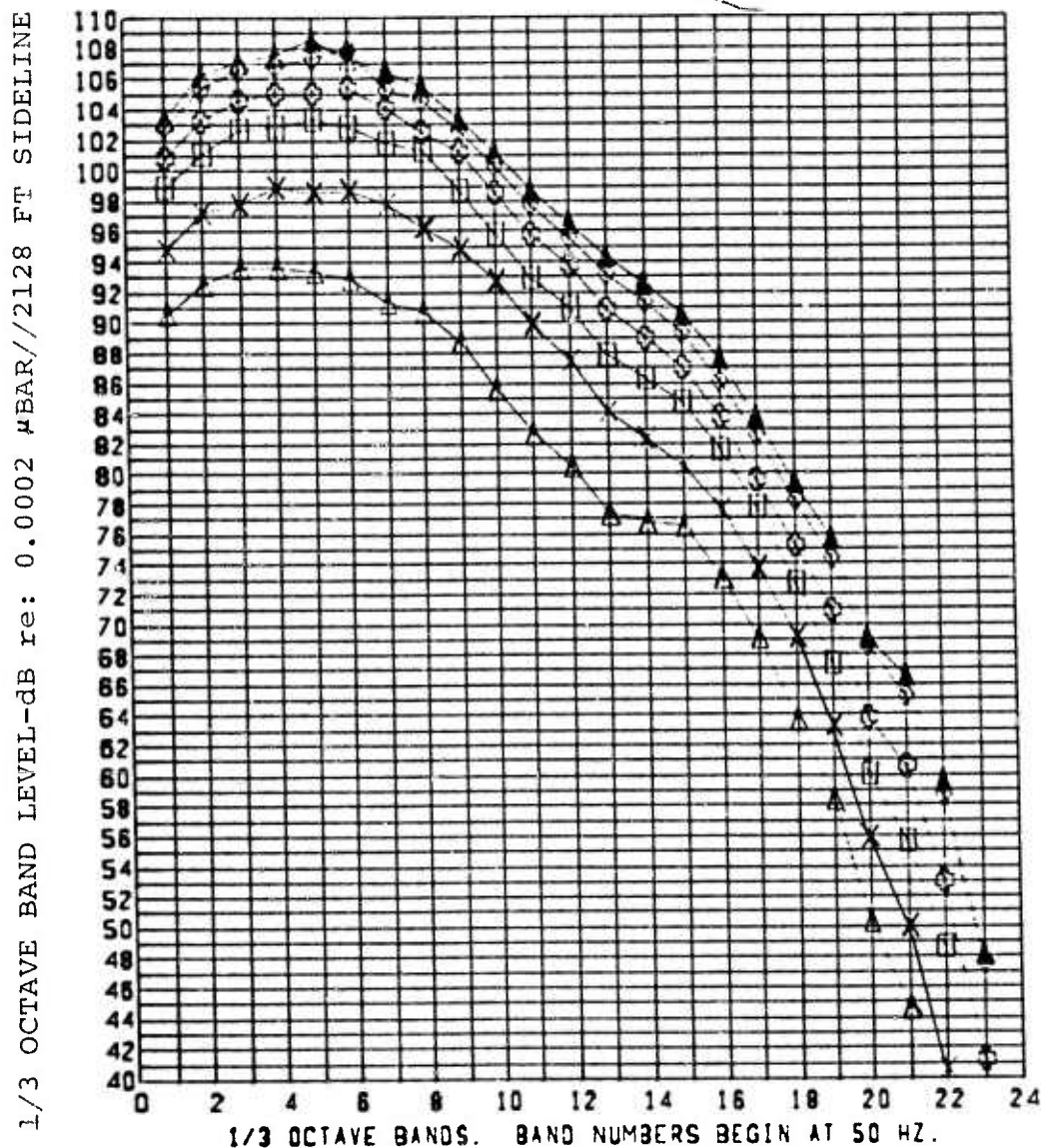
$T_T \approx 1150^\circ\text{F}$ $A_8 = 9.5 \text{ FT}^2$ RUN: 171
 $PR = \triangle 2.0, \times 2.5, \square 3.0, + 3.4, \diamond 3.7, \blacktriangle 4.0$

NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
 (NO PLUG, 3.91" DIA CENTER HOLE)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 110°
 re: NOZZLE INLET AXIS

ALT = 1000 FT, VEL = 0 FPS, S.L. = 2128 FT, 4 ENGINES

ANGLE = 130 DEG TEMP = 77 DEG R.H. = 70 PER CENT



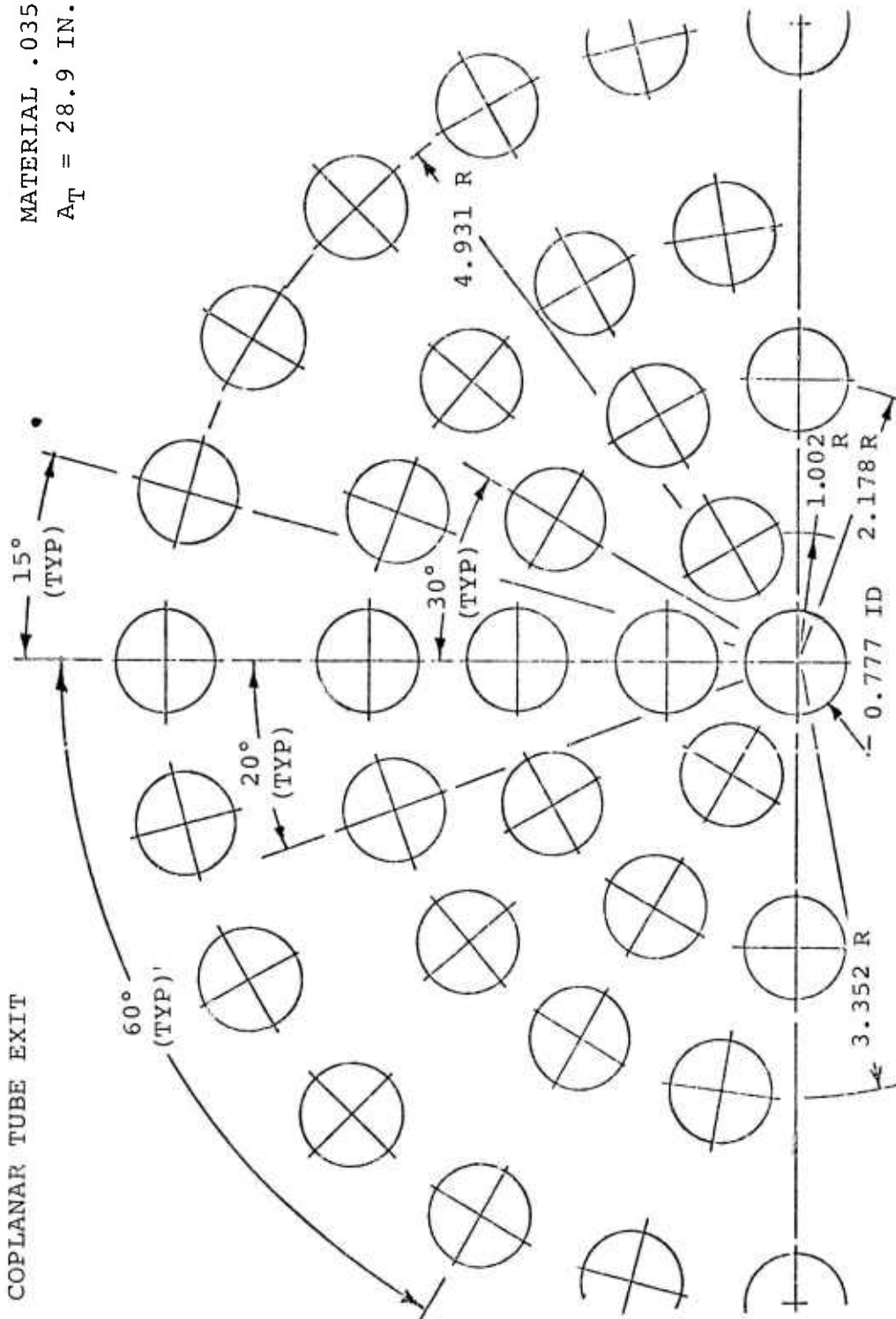
$T_t = 1150^\circ\text{F}$ $A_8 = 9.5 \text{ FT}^2$ RUN: 171
 PR = Δ 2.0, \times 2.5, \square 3.0, \oplus 3.4, \diamond 3.7, \blacktriangle 4.0

NOZZLE: 42T/ANNULUS-2.1AR-CPA-ET/RC
 (NO PLUG, 3.91" DIA CENTER HOLE)

JET NOISE SPECTRA AT THE 2128 FT. SIDELINE, 130°
 re: NOZZLE INLET AXIS

NOTE: COPLANAR TUBE EXIT

MATERIAL .035"
 $A_T = 28.9 \text{ IN.}^2$



61 TUBE AR 3.07 NOZZLE EXIT FLOW PATTERN

TEST CONDITIONS

NOZZLE: 61T-3.1AR-CPA-RT/NC

FACILITY: HNTF

DATE: 11-26-73

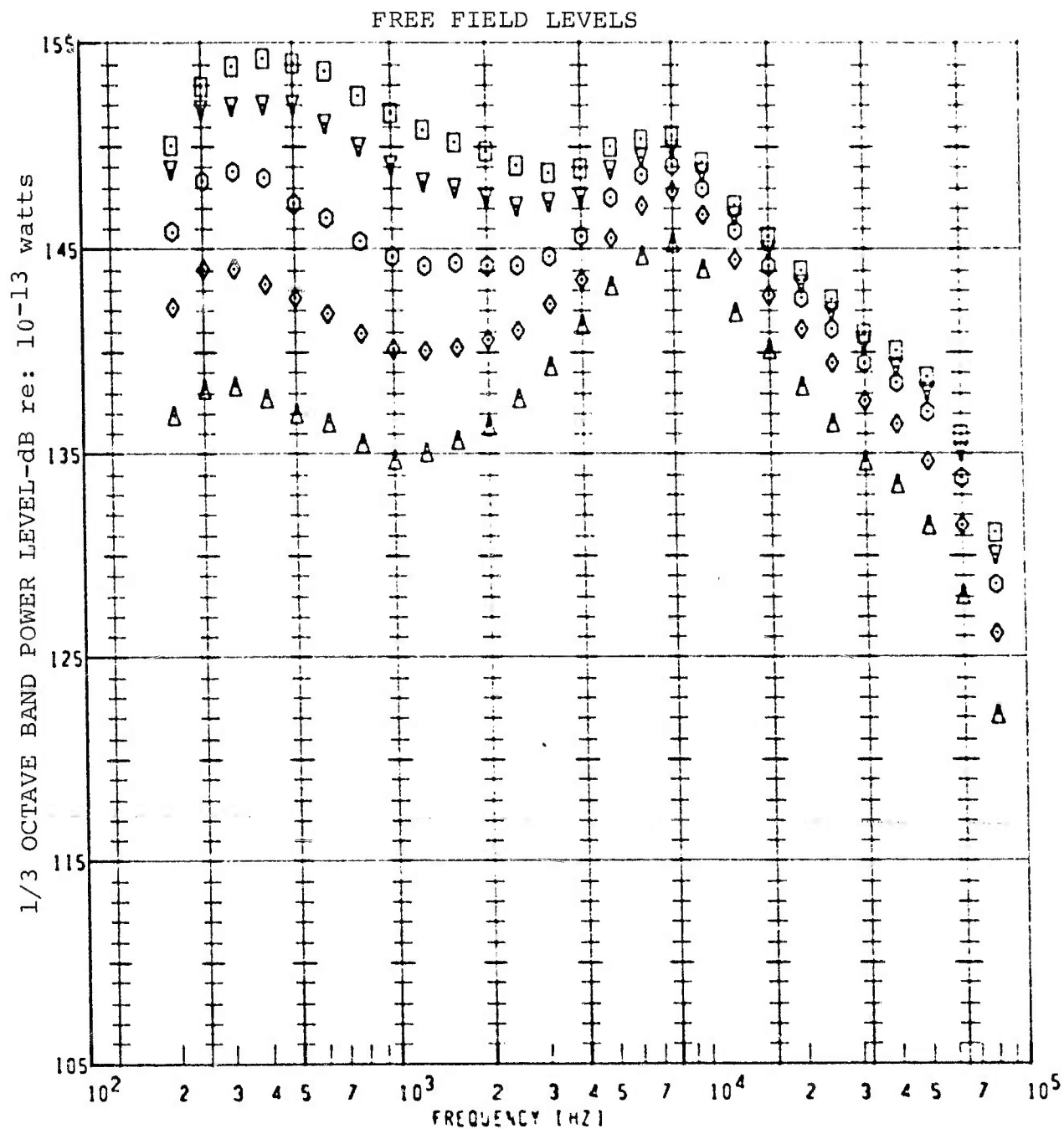
T_{AMB} = 41°F

R.H. = 91%

SCALE MODEL $A_8 = 28.9 \text{ in.}^2$

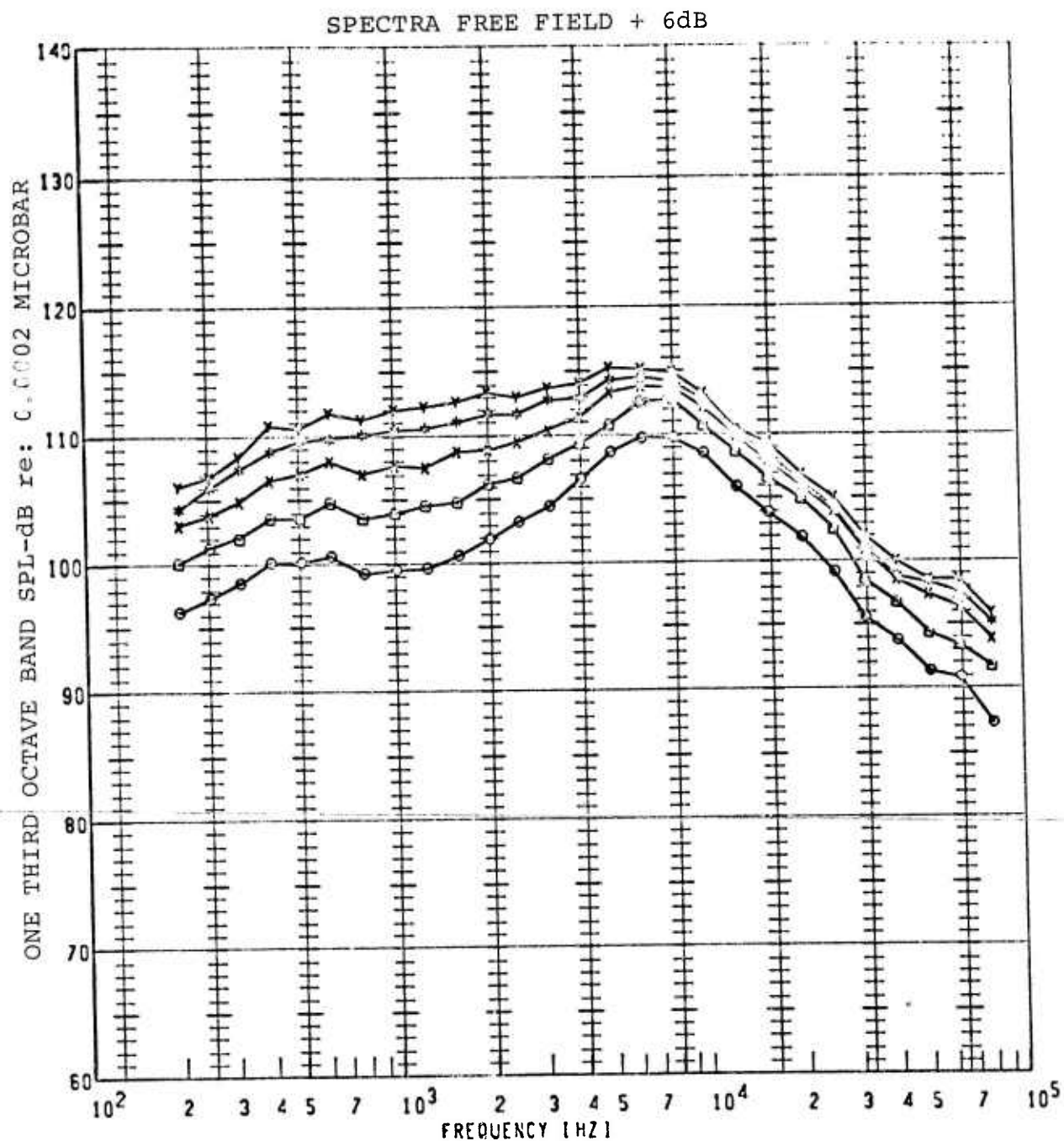
<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
07	2.0	1500°F	2072 fps	11-26-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH CONCRETE GROUND SURFACE. MEASURED ACOUSTIC DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
△	07	2.00	1500°F
◇	07	2.50	1500
○	07	3.00	1500
▽	07	3.50	1500
□	07	3.80	1500

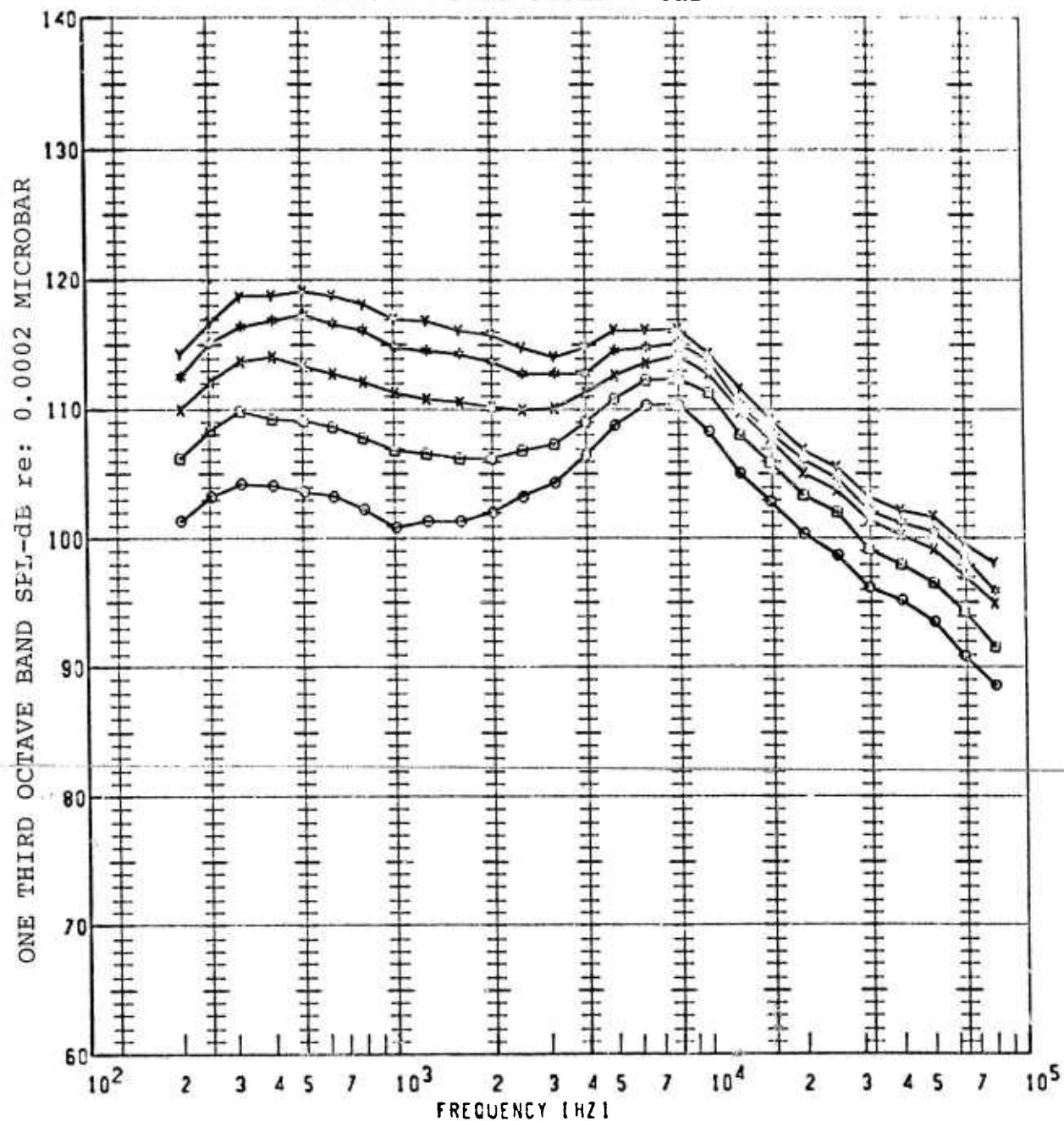
61T-3.1AR-CPA-RT/NC NOZZLE



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
○	076	1500°F	2.000	110	50FP	118.0
□	076	1500	2.500	110	50FP	121.0
x	076	1500	3.000	110	50FP	123.0
*	076	1500	3.500	110	50FP	124.5
△	076	1500	3.800	110	50FP	125.6

61T-3.1AR-CPA-RT/NC NOZZLE

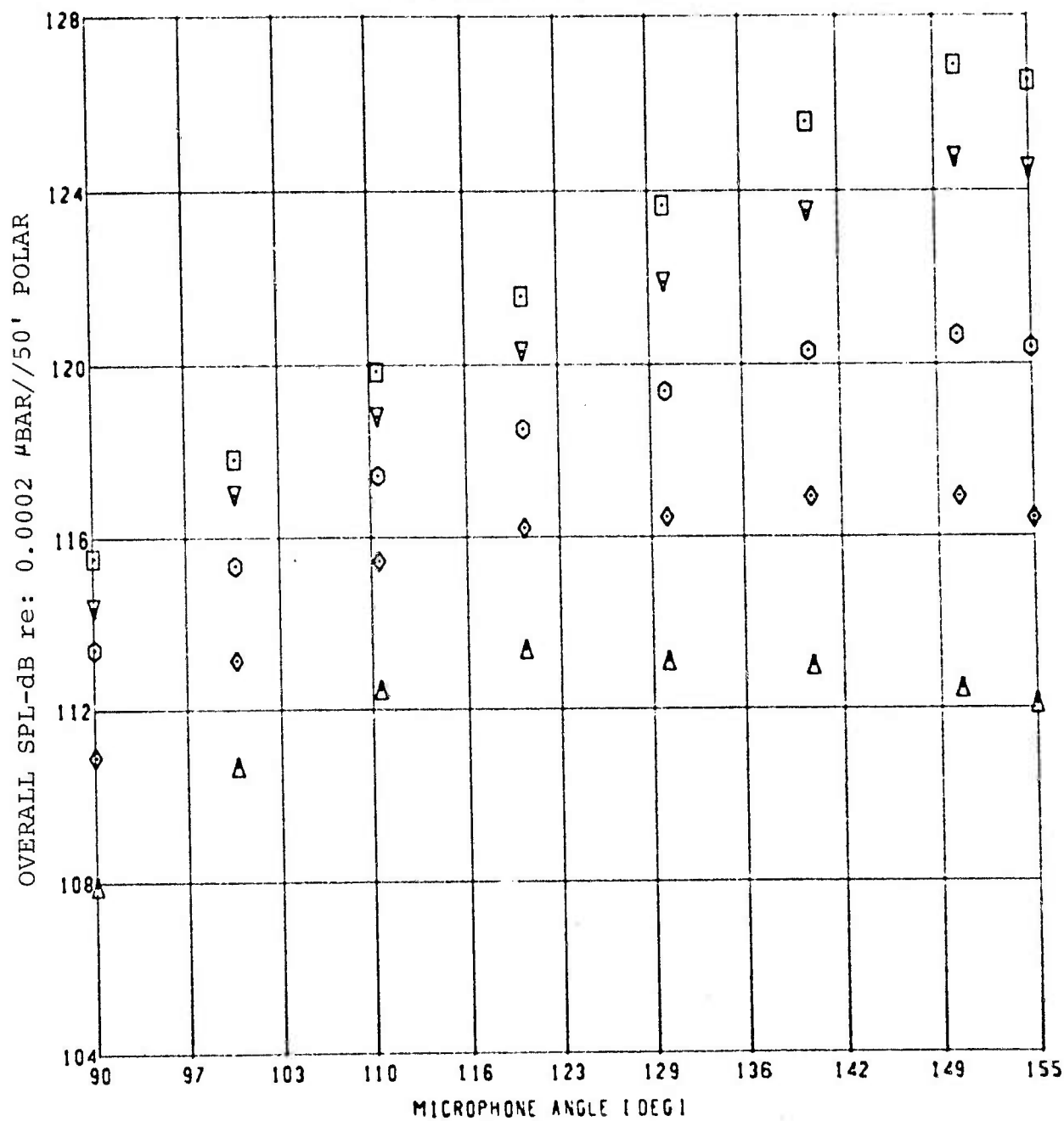
SPECTRA FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	GASPL (DB)
O	07G	1500°F	2.000	130	50FP	118.7
G	07G	1500	2.500	130	SCFP	122.1
x	07G	1500	3.000	130	50FP	125.1
*	07G	1500	3.500	130	50FP	127.7
y	07G	1500	3.800	130	50FP	129.5

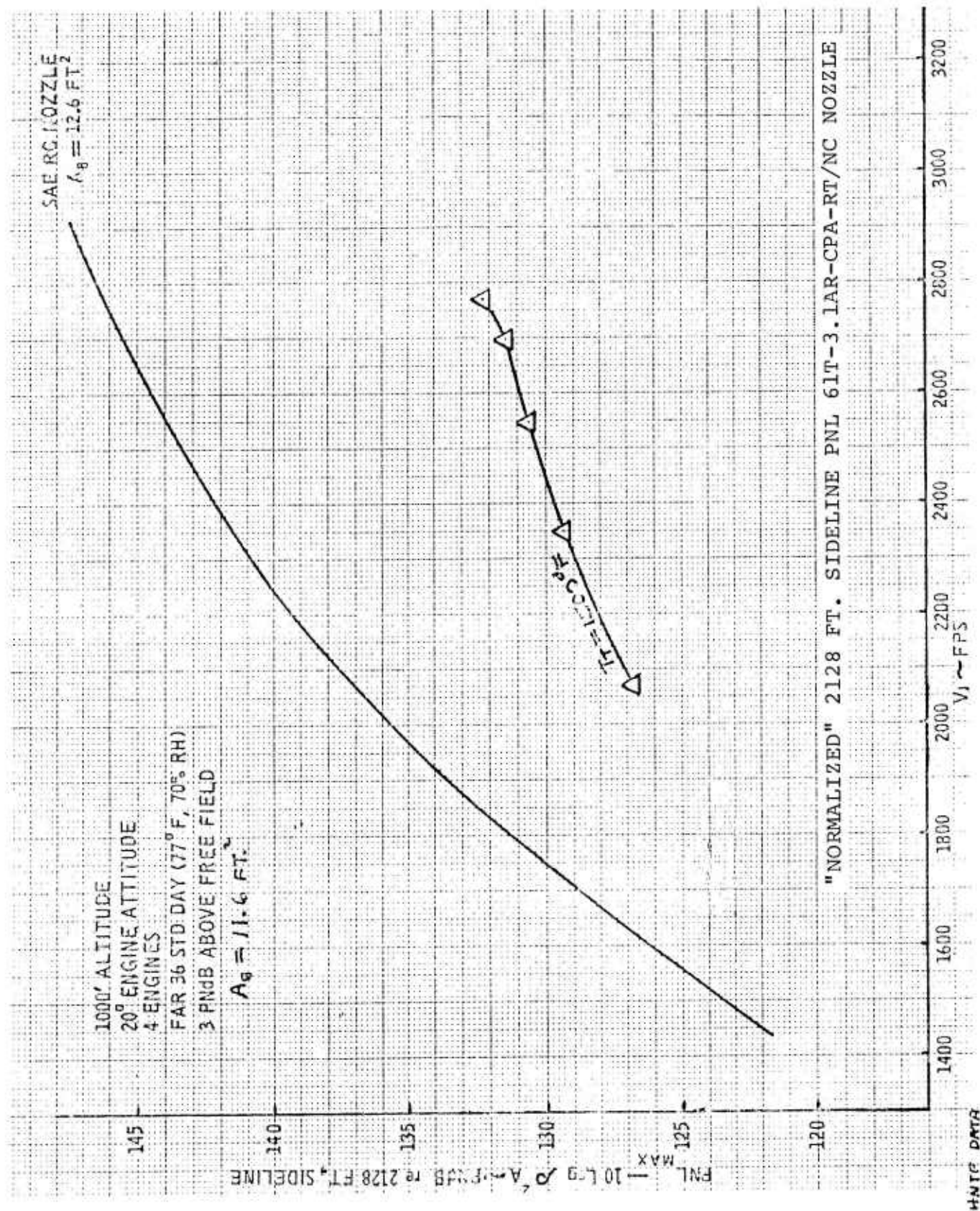
61T-3.1AR-CPA-RT/NC NOZZLE

FREE FIELD LEVELS

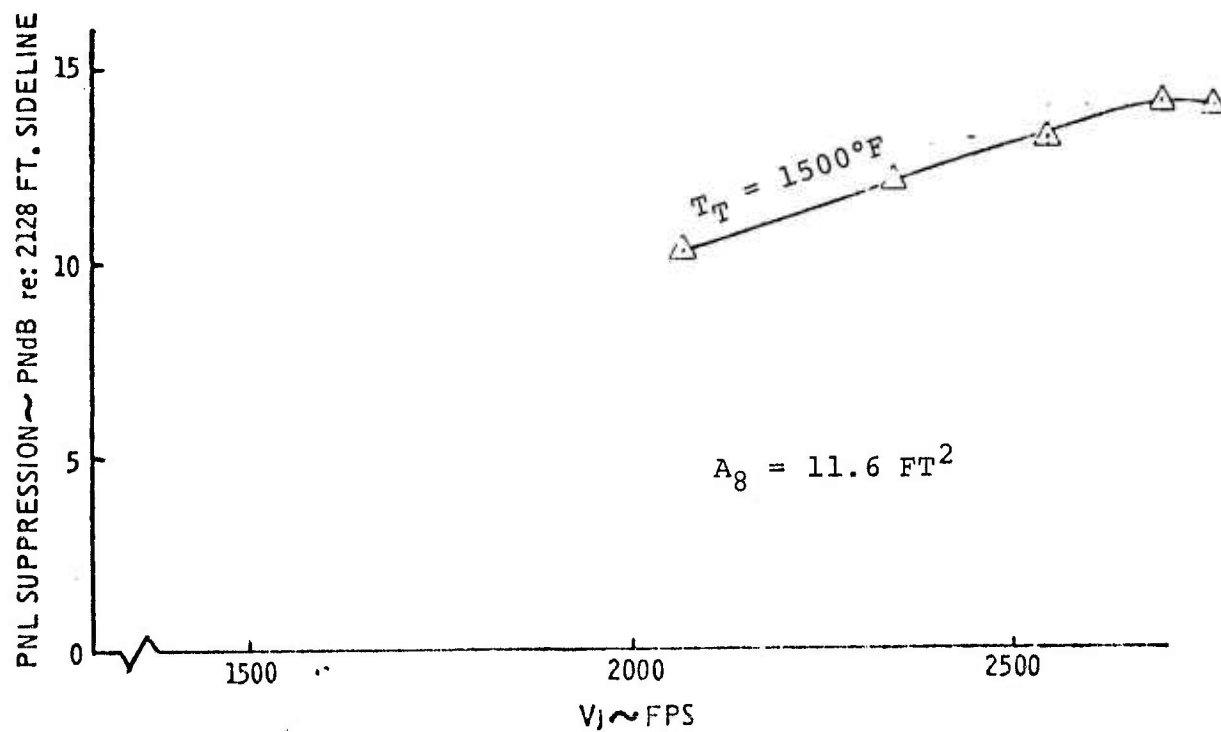


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	07	2.00	1500 °F
◆	07	2.50	1500
○	07	3.00	1500
▼	07	3.50	1500
◻	07	3.80	1500

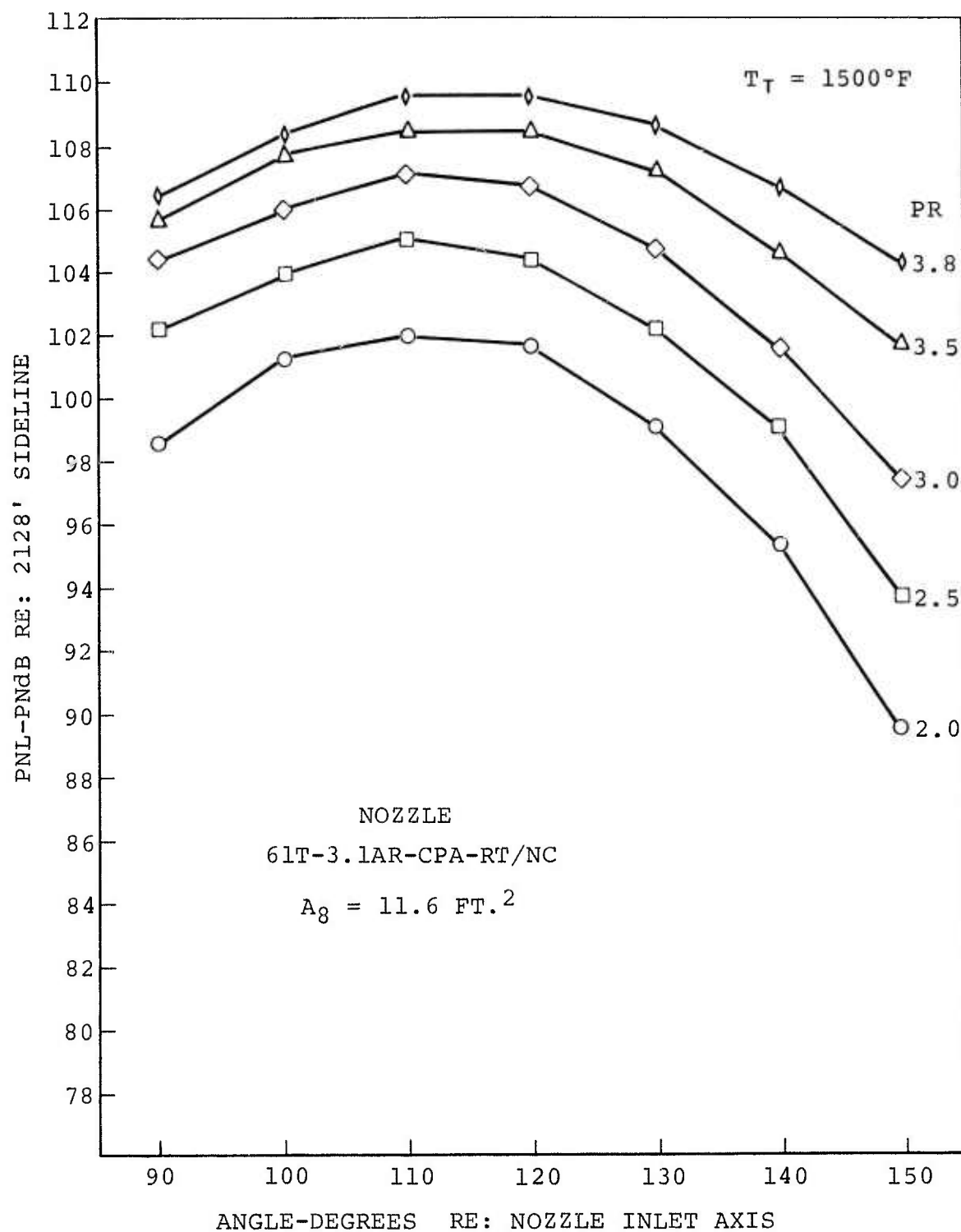
61T-3.1AR-CPA-RT/NC NOZZLE



61T-3.1AR-CPA-RT/NC NOZZLE

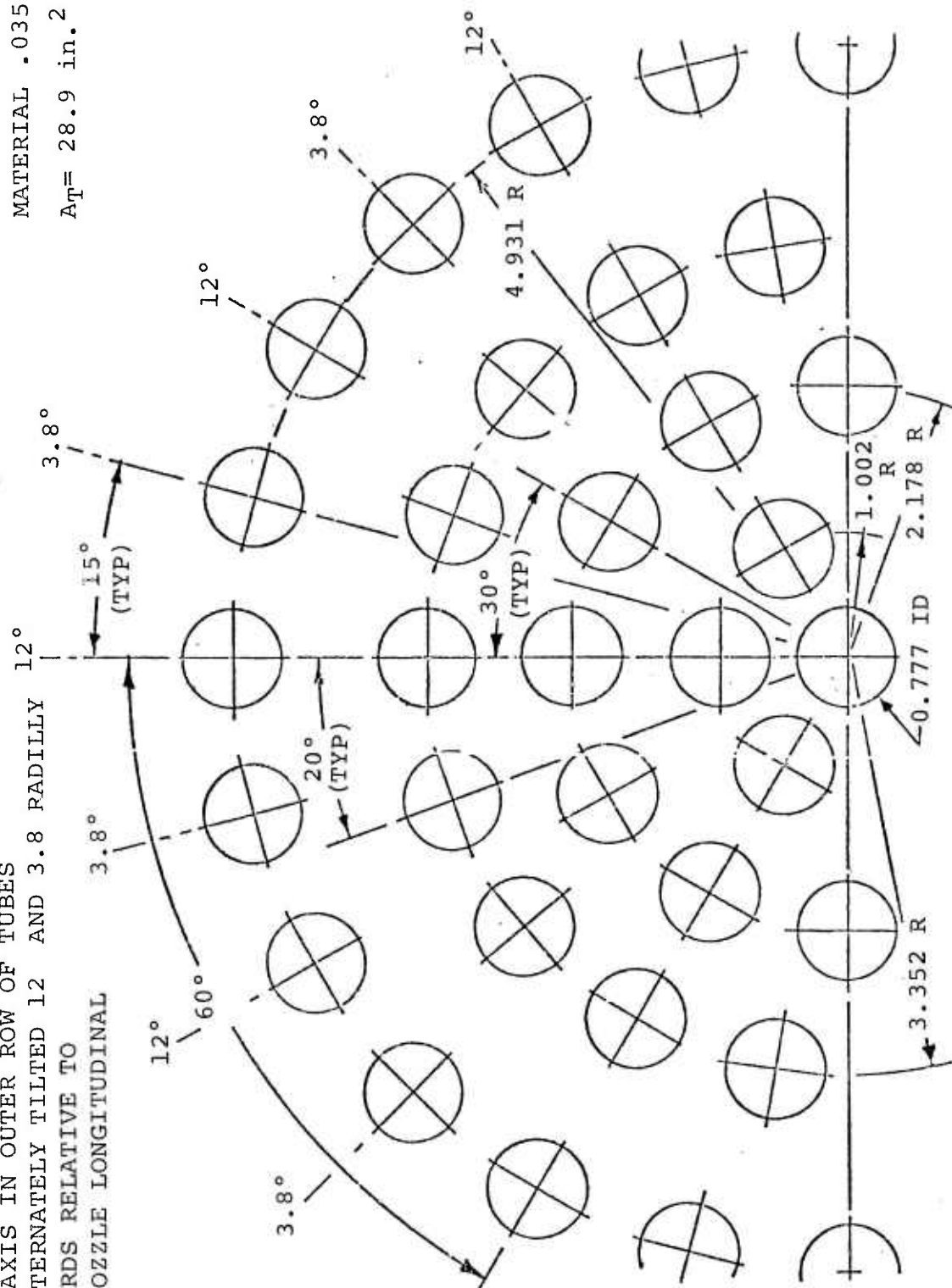


PEAK PNL SUPPRESSION VALUES



61 TUBE 3.1AR NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN

FLOW AXIS IN OUTER ROW OF TUBES
IS ALTERNATELY TILTED 12 AND 30
OUTWARDS RELATIVE TO
THE NOZZLE LONGITUDINAL
AXIS



61 TUBE AR 3.07 NOZZLE EXIT FLOW PATTERN (WITH TILTED OUTER ROW OF TUBES)

TEST CONDITIONS

NOZZLE: 61T- (CANTED) -3.1AR-CPA-RT/NC

FACILITY: HNTF

DATE: 12-3-73

T_{AMB} = 50°F

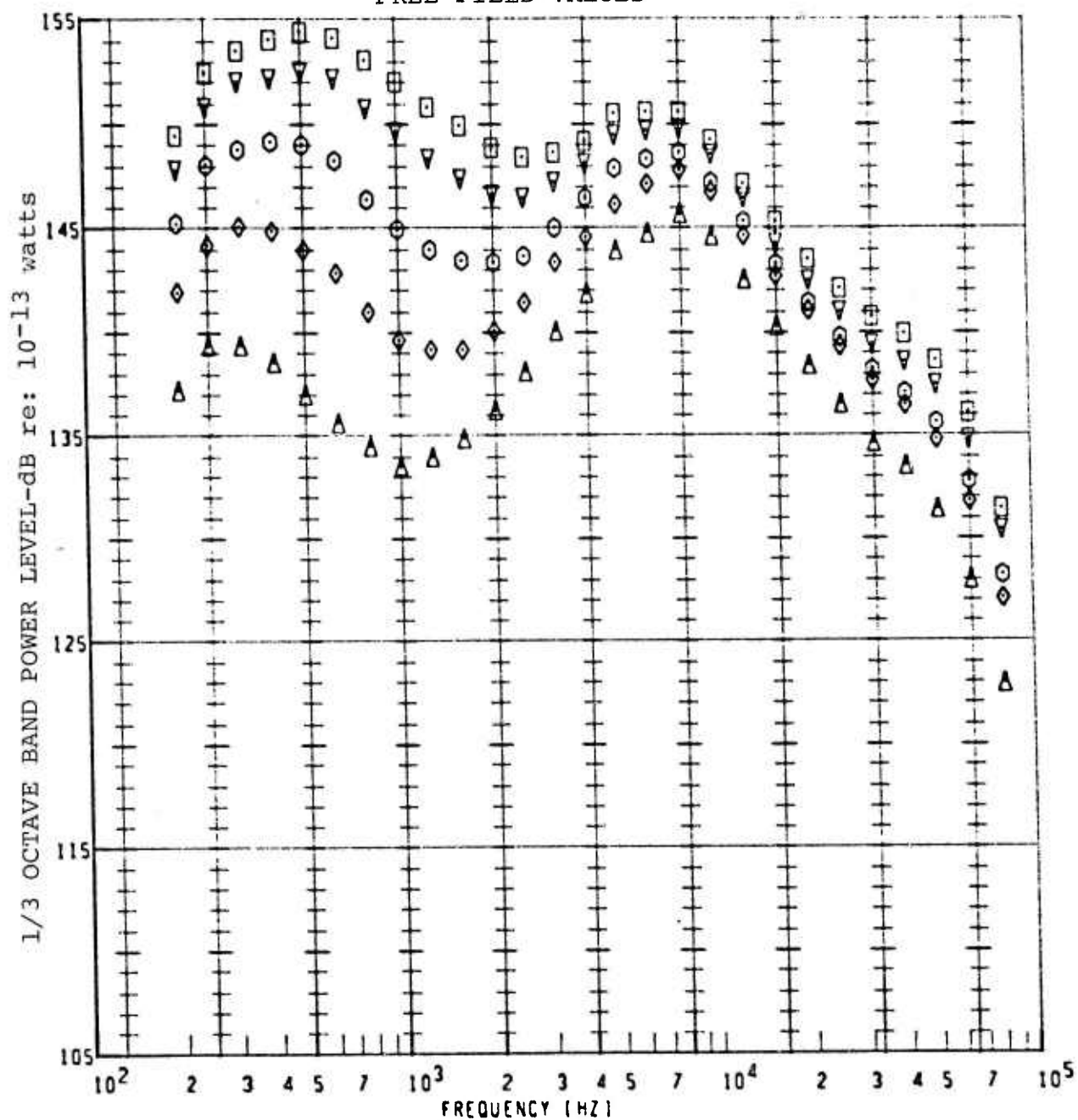
R.H. = 67%

SCALE MODEL $A_8 = 28.9 \text{ in.}^2$

<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
18	2.0	1500°F	2072 fps	12-3-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
(HNTF) CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.

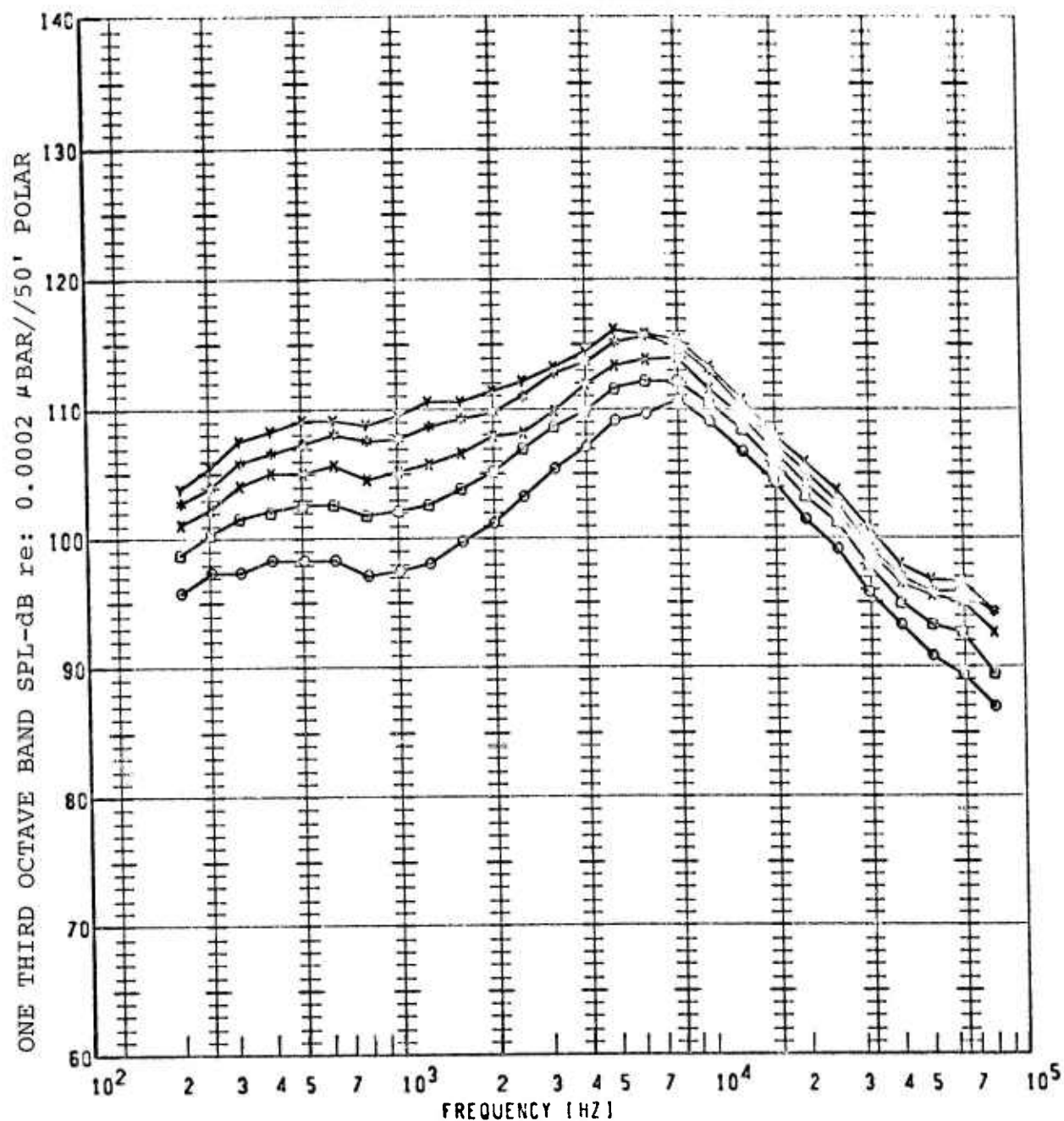
FREE FIELD VALUES



PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	18	2.00	1500°F
◆	18	2.50	1500
○	18	3.00	1500
▼	18	3.50	1500
◻	18	3.80	1500

61T- (CANTED) -3.1AR-CPA-RT/NC NOZZLE

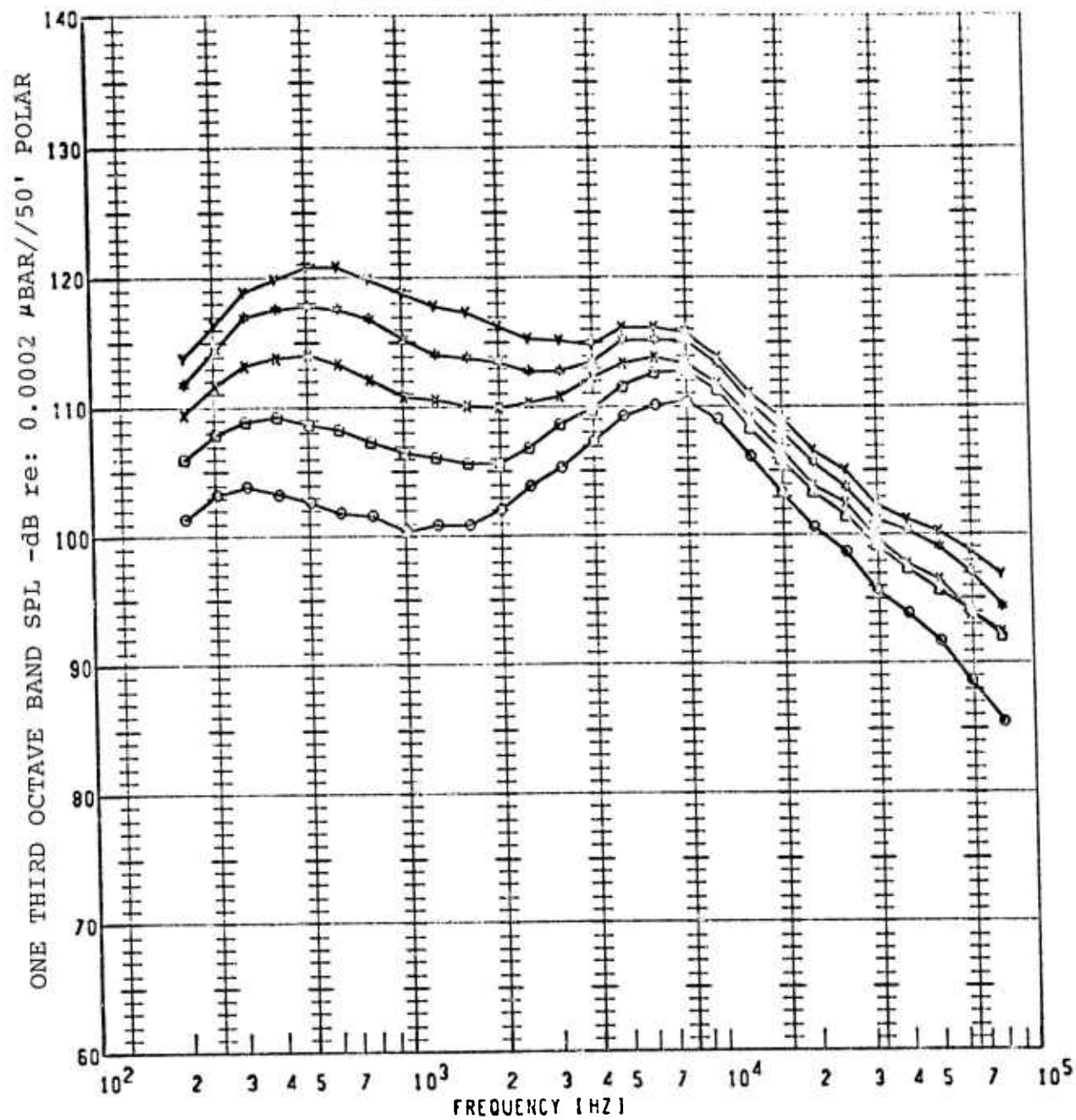
SPECTRA ARE FREE FIELD + 6dB



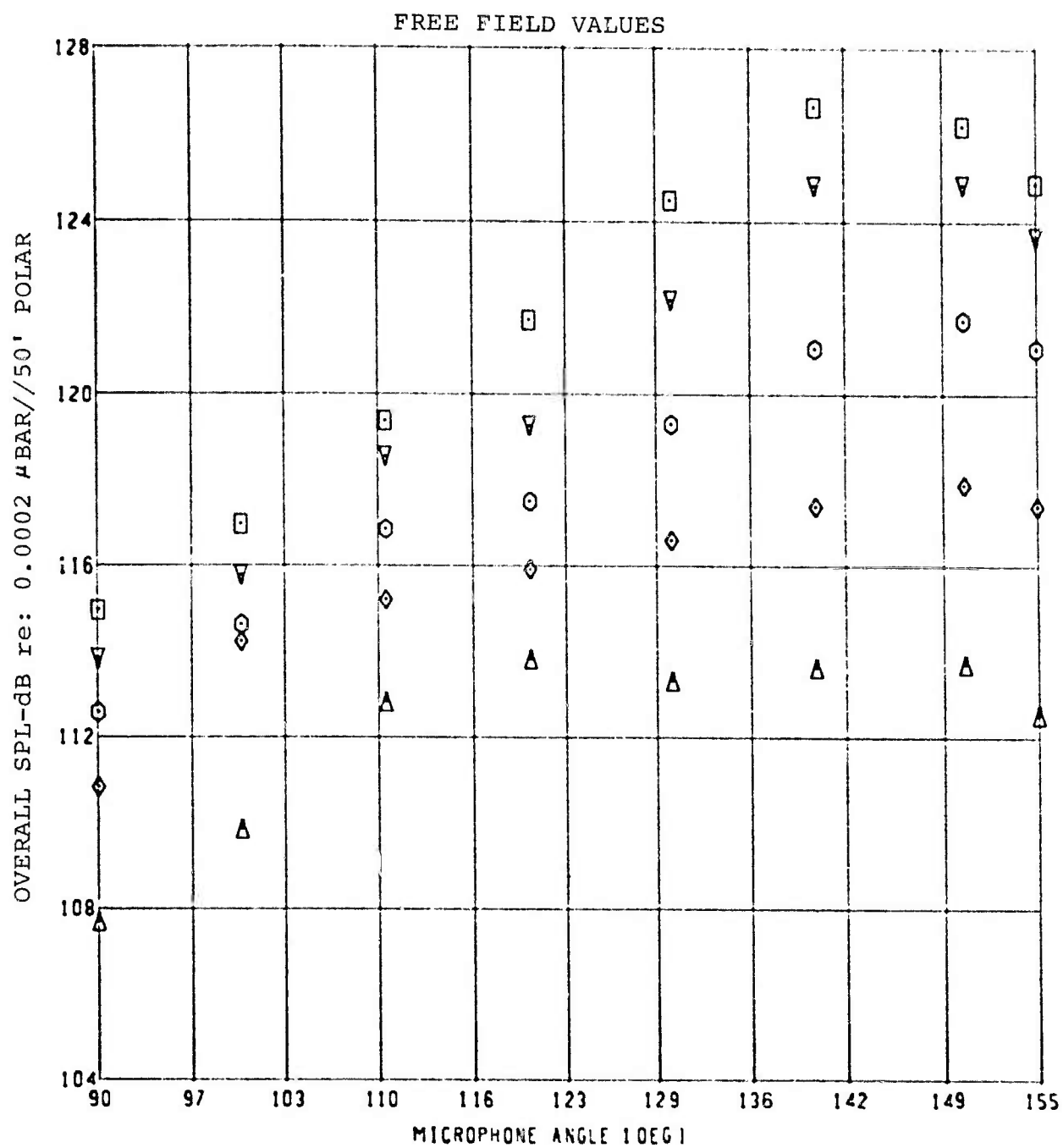
PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL (DB)
o	186	1500°F	2.000	110	50FP	118.2
□	186	1500	2.500	110	50FP	120.6
x	186	1500	3.000	110	50FP	122.4
*	186	1500	3.500	110	50FP	124.1
y	186	1500	3.800	110	50FP	125.0

61T-(CANTED)-3.1AR-CPA-RT/NC NOZZLE

SPECTRA ARE FREE FIELD + 6dB

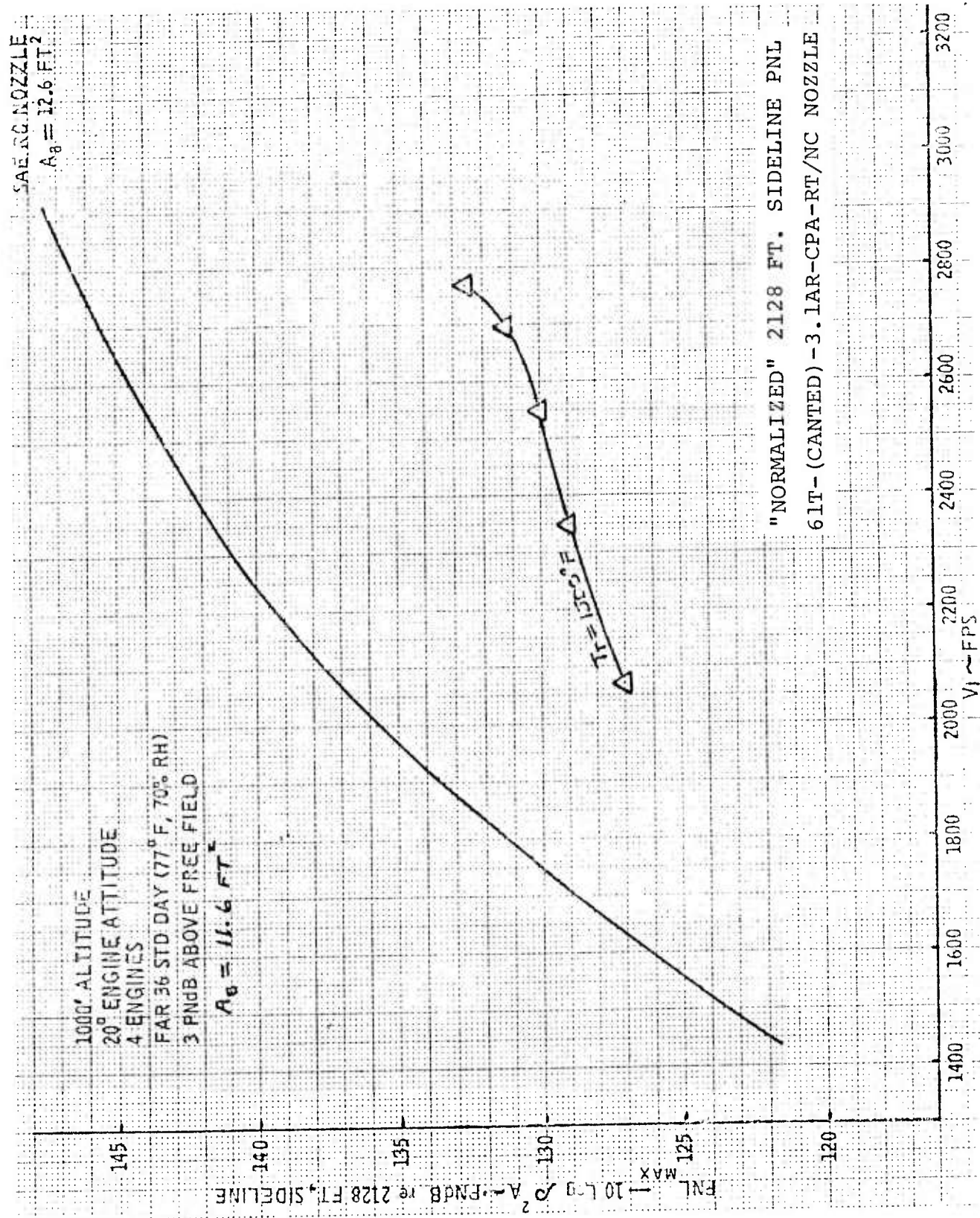


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [dB]
o	18G	1500°F	2.000	130	SOFP	118.8
□	18G	1500	2.500	130	SOFP	122.2
x	18G	1500	3.000	130	SOFP	125.0
*	18G	1500	3.500	130	SOFP	128.0
Δ	18G	1500	3.800	130	SOFP	130.3

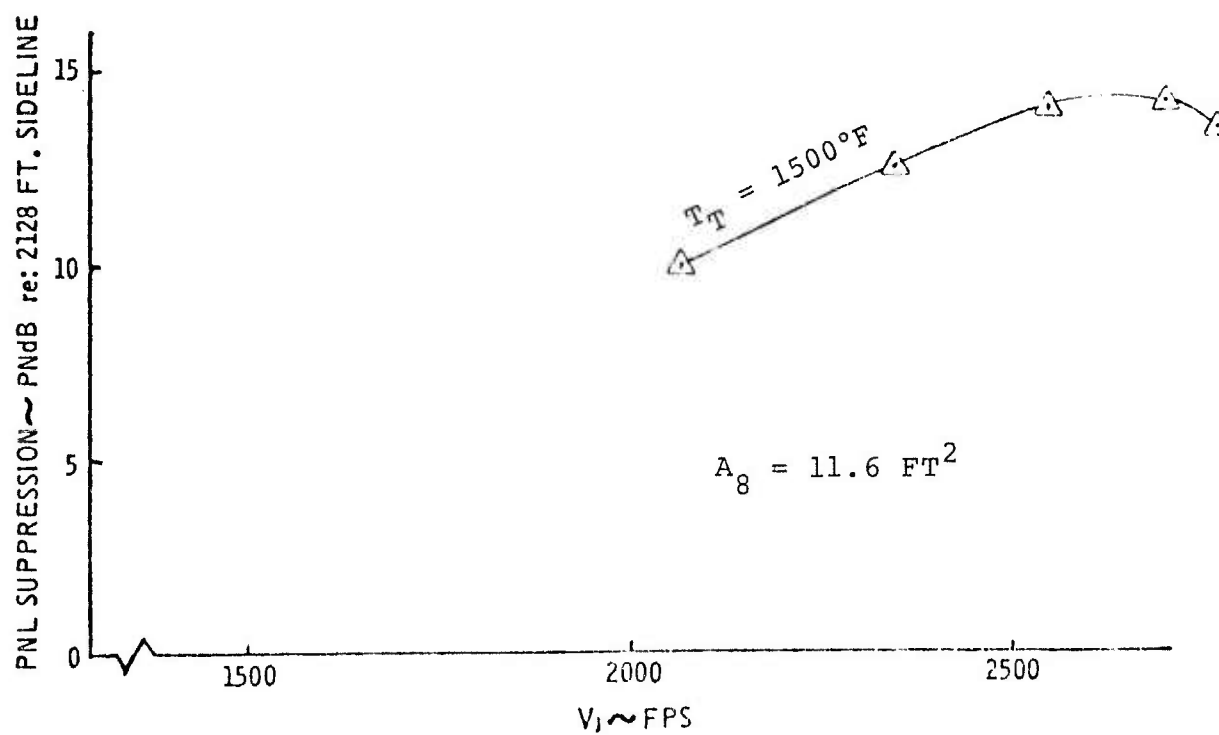


PLOT SYMBOL	RUN NUMBER	PRESSURE RATIO	JET TEMP
▲	18	2.00	1500°F
◆	18	2.50	1500
○	18	3.00	1500
▼	18	3.50	1500
◻	18	3.80	1500

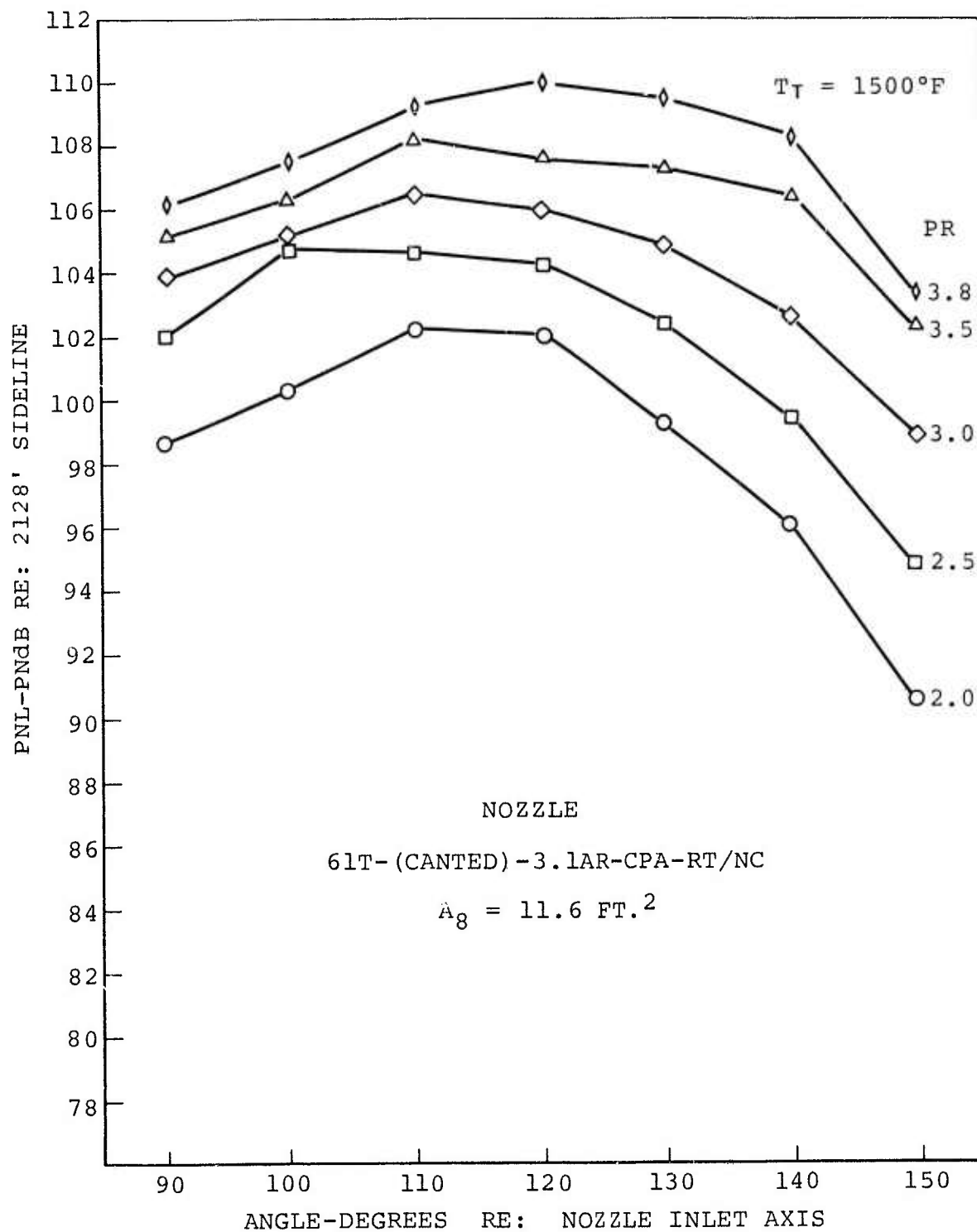
61T- (CANTED) -3.1AR-CPA-RT/NC NOZZLE



61T- (CANTED) -3.1AR-CPA-RT/NC NOZZLE



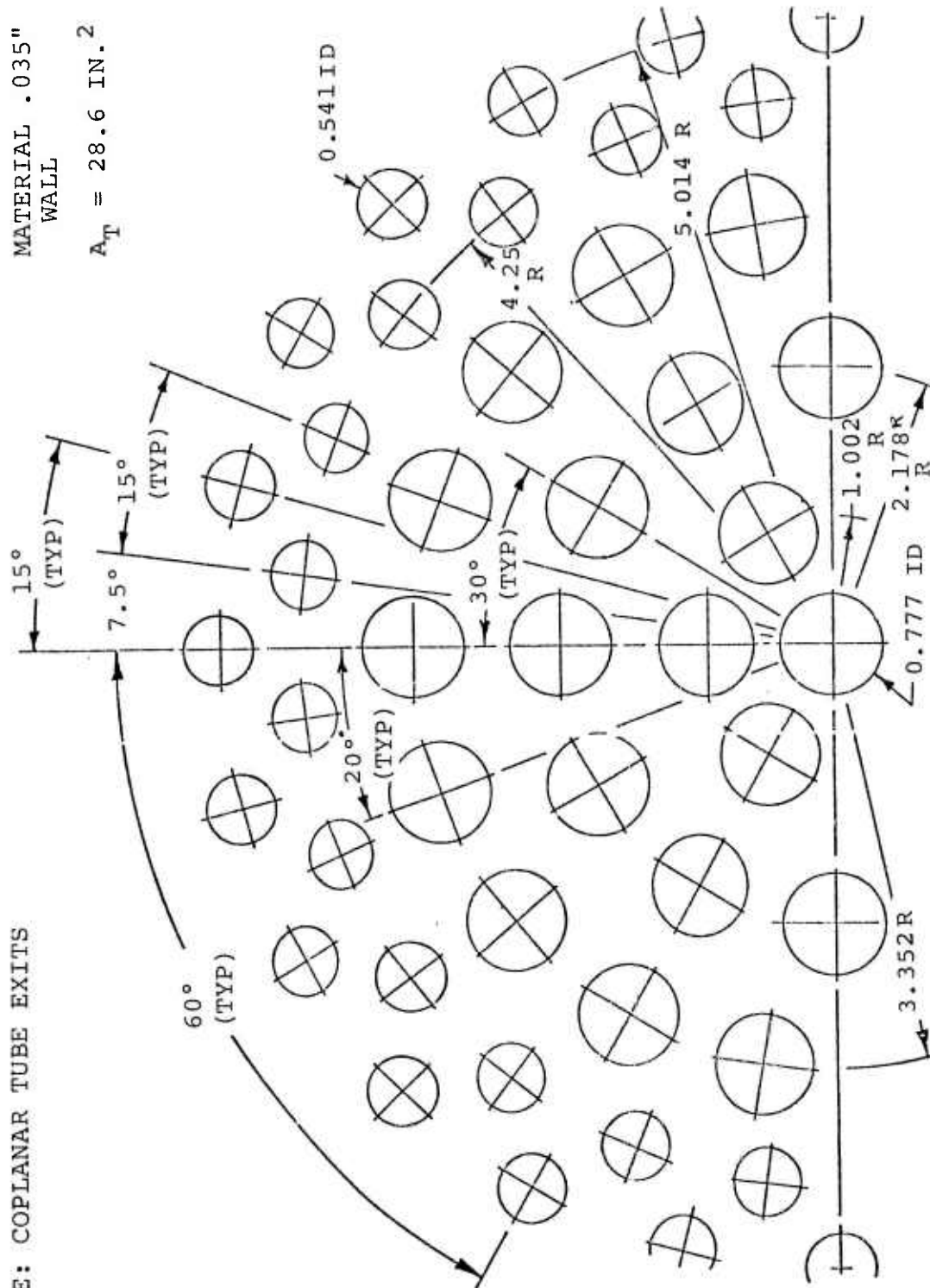
PEAK PNL SUPPRESSION VALUES



61 TUBE (CANTED) 3.1AR NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN

NOTE: COPLANAR TUBE EXITS

MATERIAL .035"
WALL
 $A_T = 28.6 \text{ IN.}^2$



85 TUBE AR 3.07 NOZZLE EXIT FLOW PATTERN

TEST CONDITIONS

NOZZLE: 85T-3.1AR-CPA-RT/NC

FACILITY: HNTF

DATE: 12-4-73

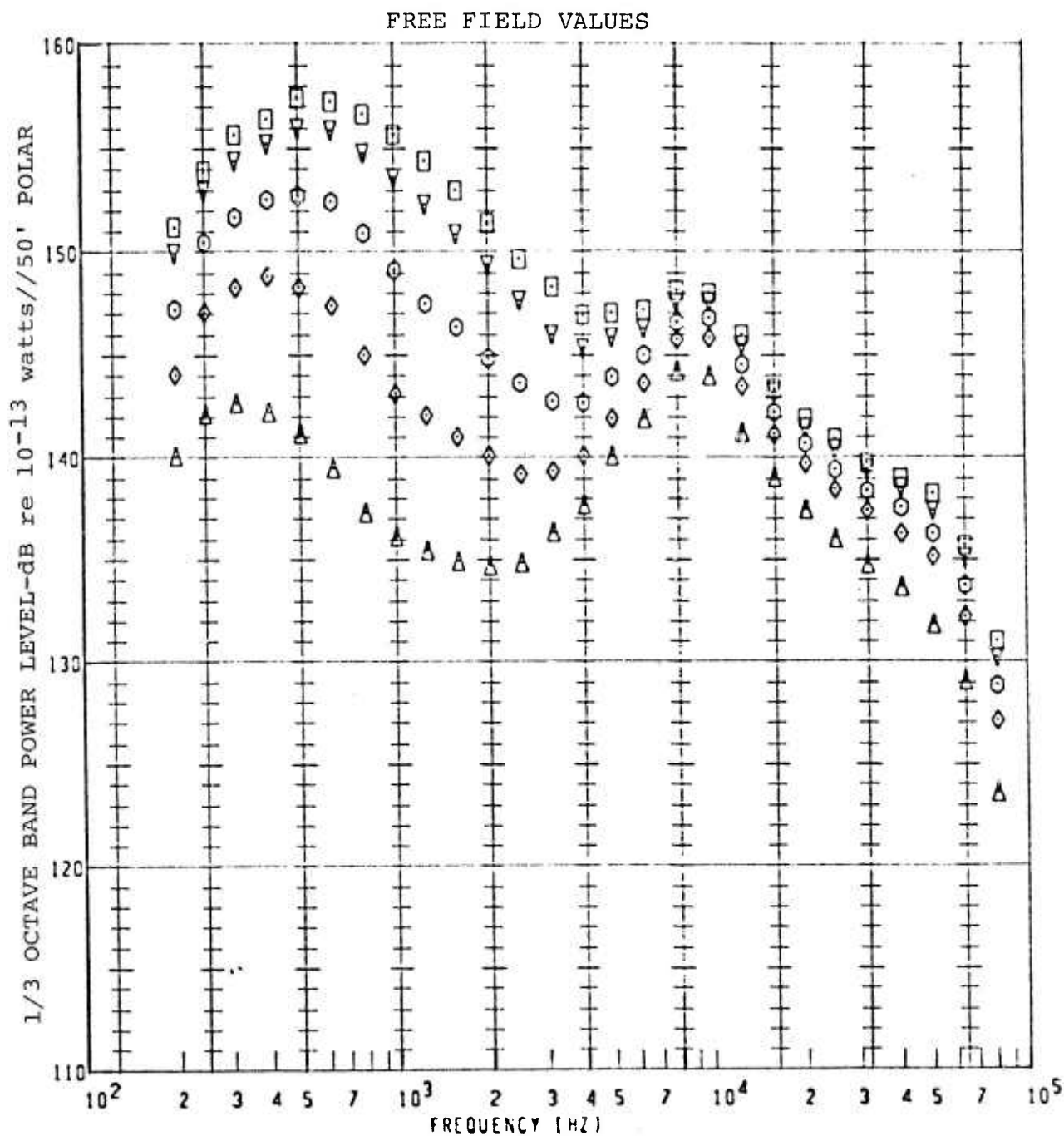
T_{AMB} =

R.H. =

SCALE MODEL A₈ =

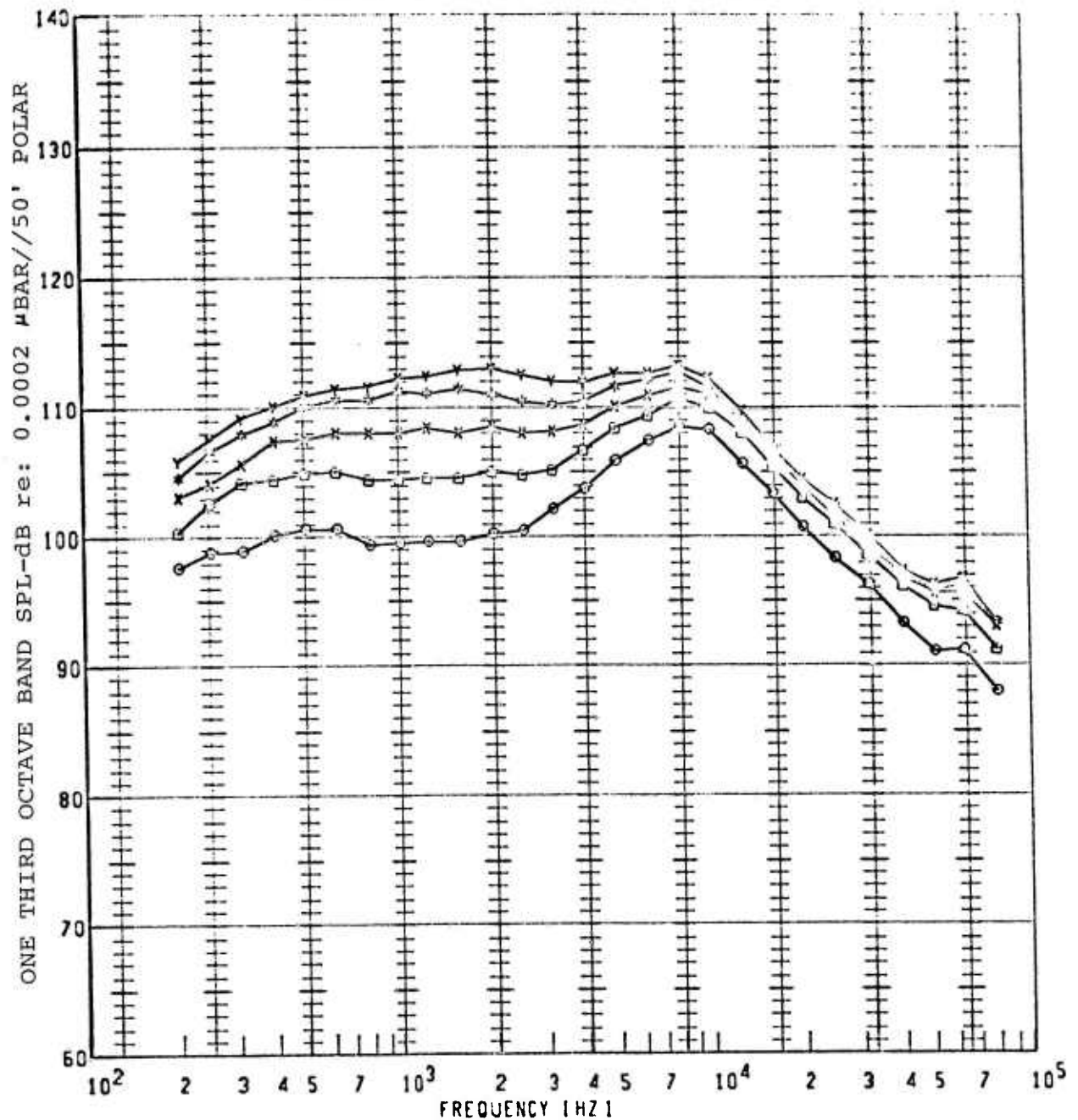
<u>RUN NO.</u>	<u>NPR</u>	<u>T_T</u>	<u>V_J (IDEAL)</u>	<u>REMARKS</u>	<u>REF</u>
21	2.0	1500°F	2072 fps	12-4-73	
"	2.5	"	2351	"	
"	3.0	"	2548	"	
"	3.5	"	2697	"	
"	3.8	"	2771	"	

MICROPHONE LAYOUT: 50 FOOT POLAR ARC, MICROPHONES FLUSH WITH
CONCRETE GROUND SURFACE. MEASURED ACOUSTIC
DATA IS +6 dB RELATIVE TO FREE-FIELD VALUES.



85T-3.1AR-CPA-RT/NC NOZZLE

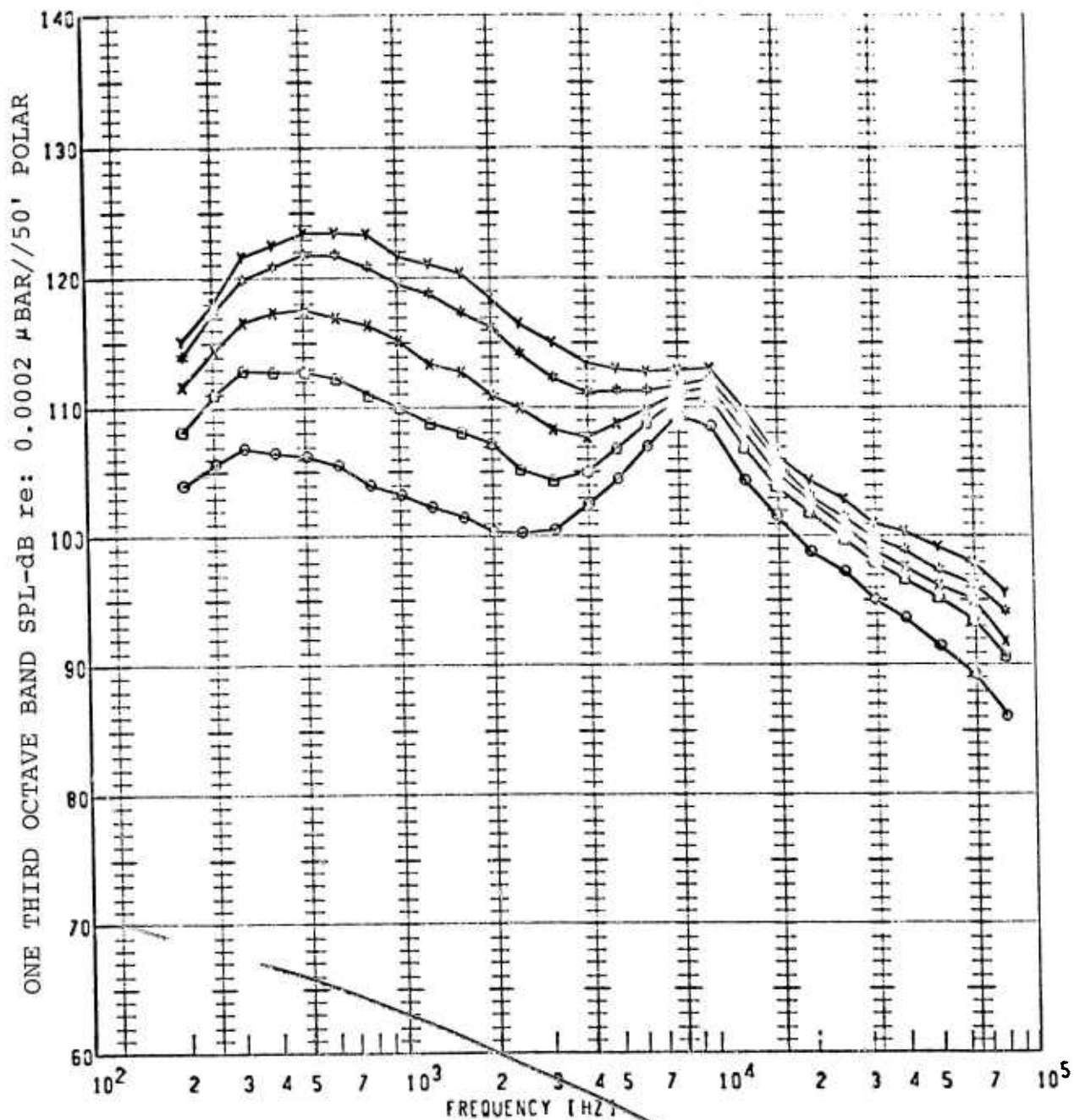
SPECTRA ARE FREE FIELD + 6dB



PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	OASPL [DB]
o	21G	1500°F	2.000	110	50FP	116.7
G	21G	1500	2.500	110	50FP	119.7
x	21G	1500	3.000	110	50FP	121.7
*	21G	1500	3.500	110	50FP	123.5
y	21G	1500	3.800	110	50FP	124.6

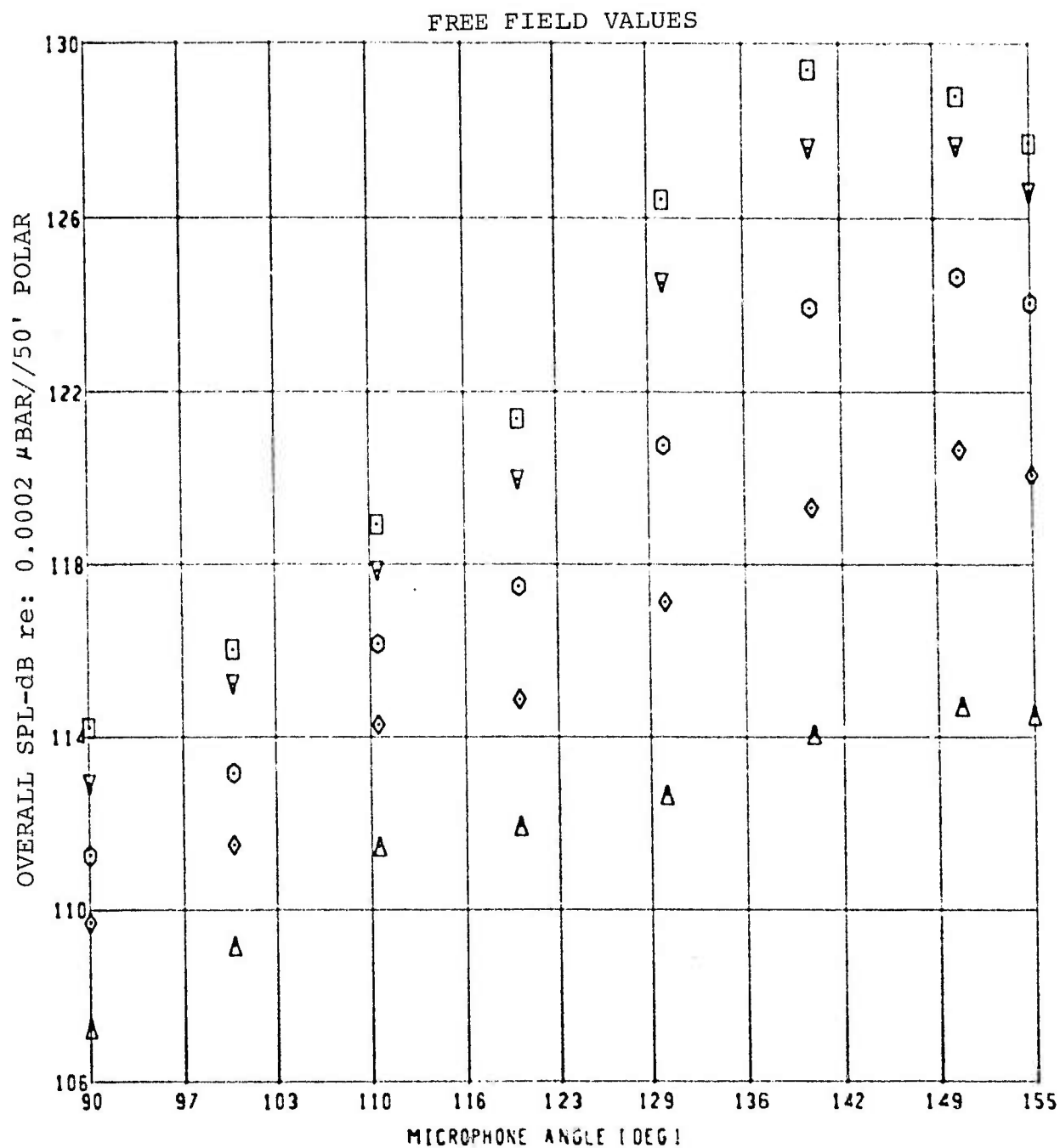
85T-3.1AR-CPA-RT/NC NOZZLE

SPECTRA ARE FREE FIELD + 6dB

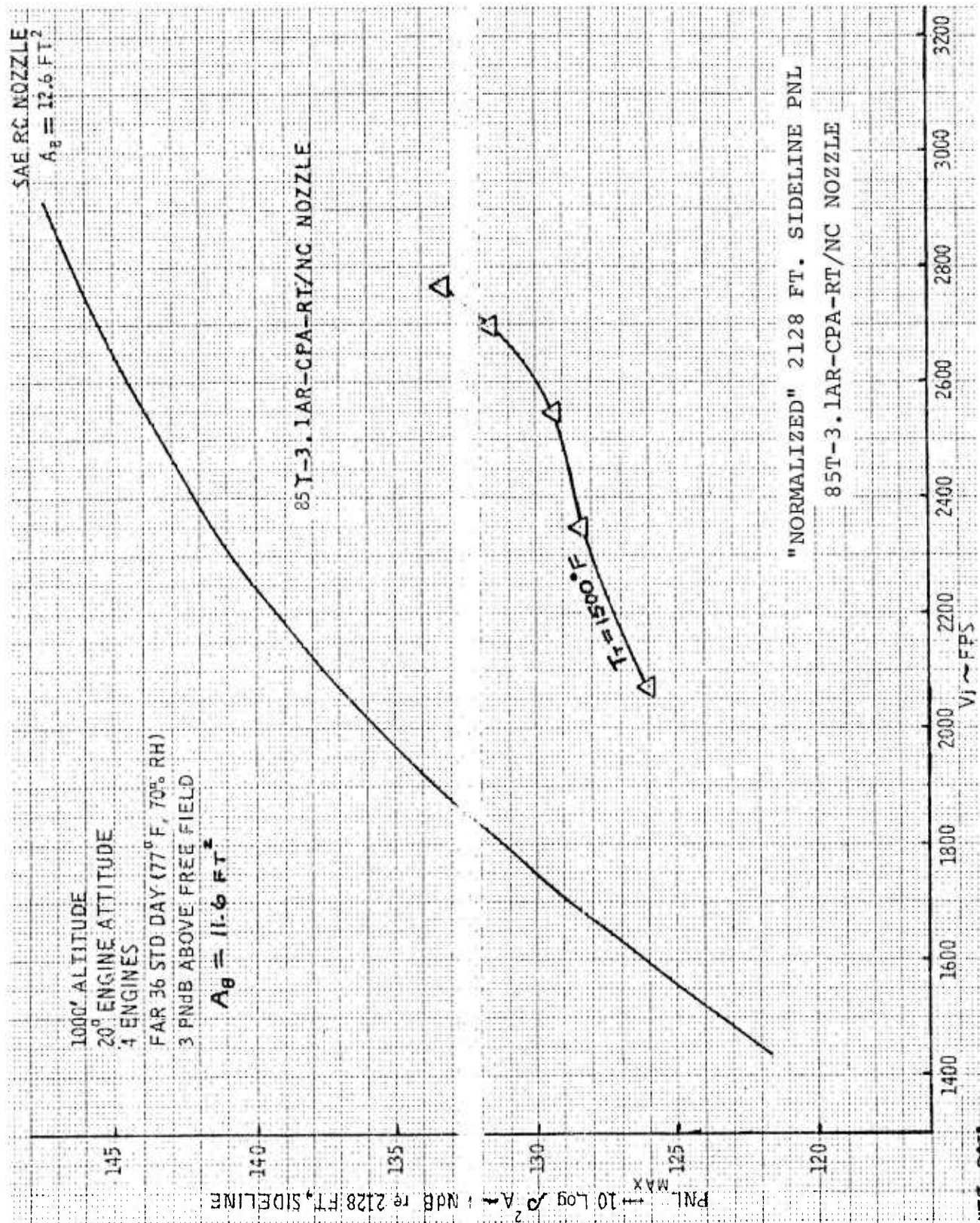


PLOT SYMBOL	RUN NUMBER	JET TEMP	PRESSURE RATIO	ANGLE RE INLET	OBSERVER LOCATION	CASPL [DB]
o	216	1500°F	2.000	130	50FP	118.2
G	216	1500	2.500	130	50FP	122.8
x	216	1500	3.000	130	50FP	126.6
*	216	1500	3.500	130	50FP	130.5
y	216	1500	3.800	130	50FP	132.4

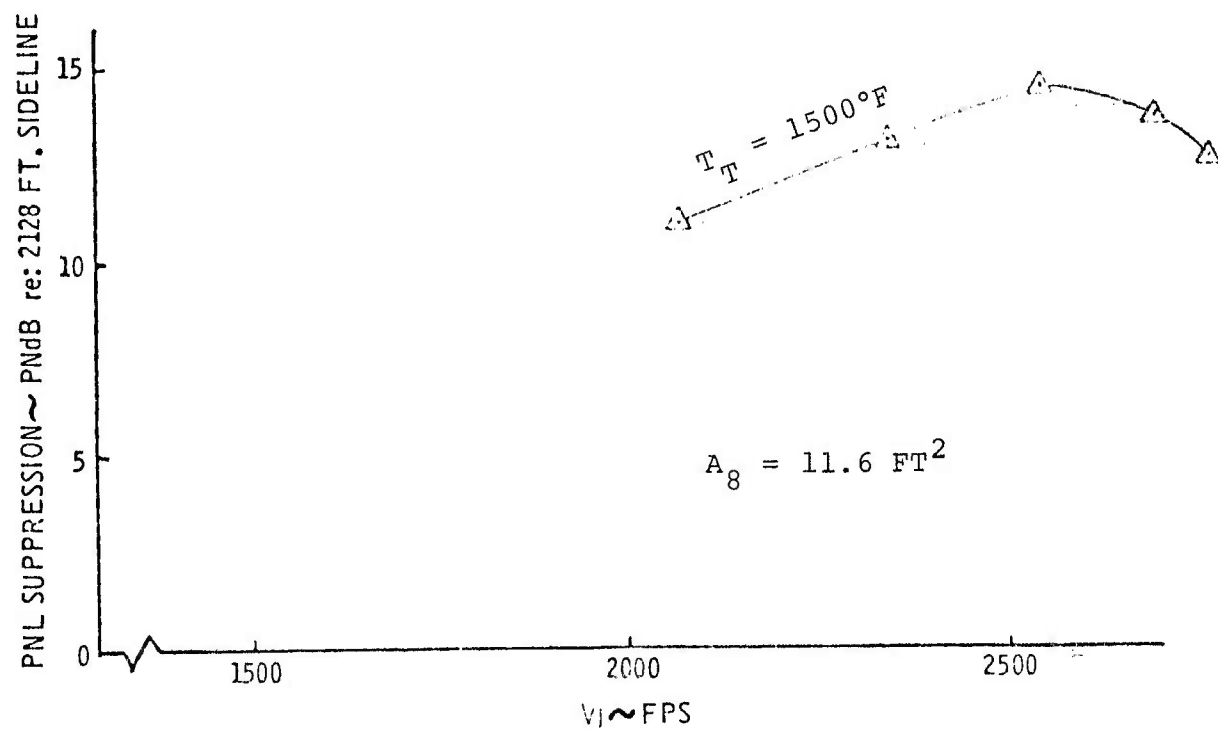
85T-3.1AR-CPA-RT/NC NOZZLE



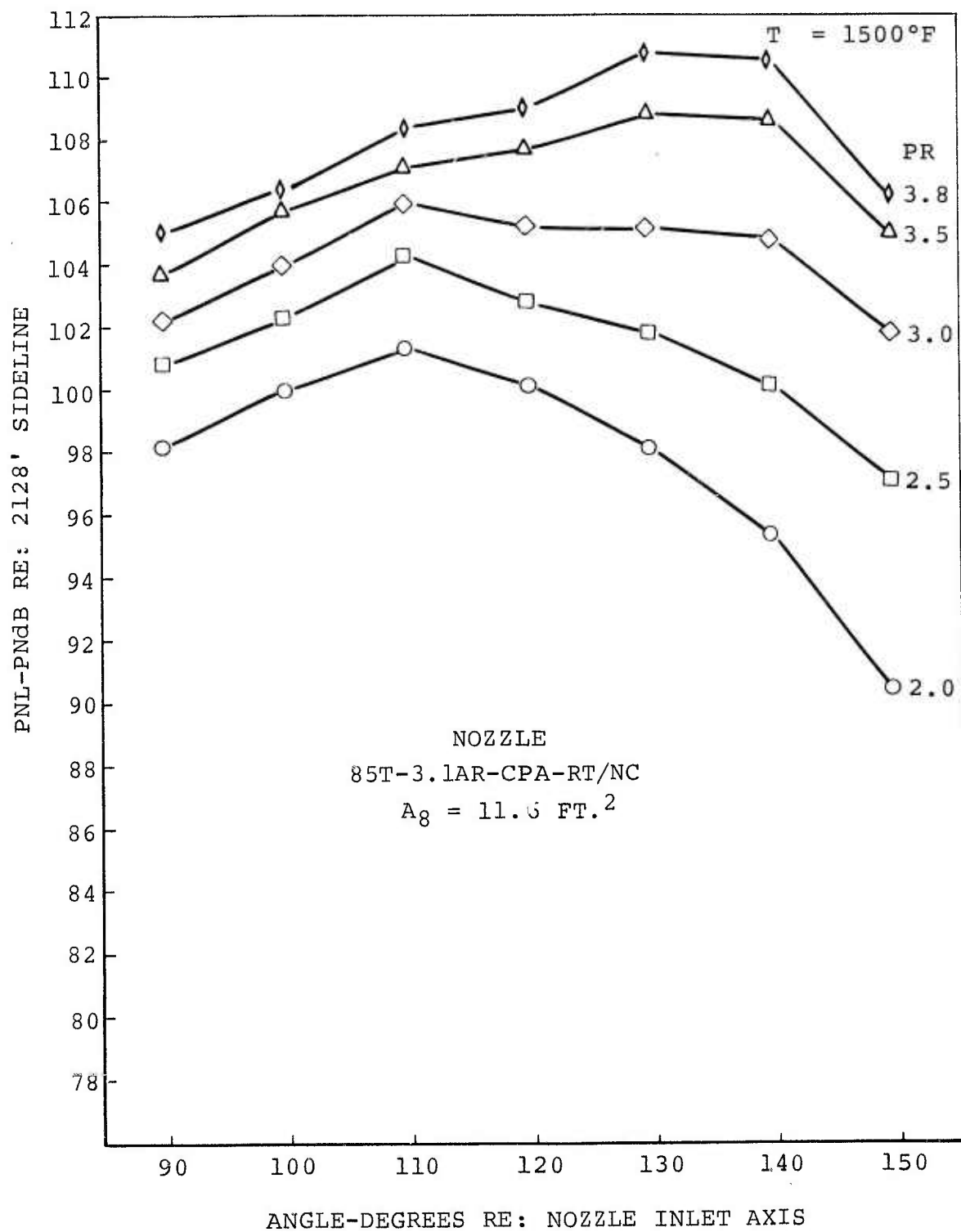
85T-3.1AR-CPA-RT/NC NOZZLE



85 T -3.1AR-CPA-RT/NC NOZZLE



PEAK PNL SUPPRESSION VALUES



85 TUBE 3.1AR NOZZLE PERCEIVED NOISE LEVEL BEAM PATTERN